

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAII

In the Matter of the Application of)
)
HAWAII ELECTRIC LIGHT COMPANY, INC.) DOCKET NO. 2017-0122
)
For Approval of a Power Purchase Agreement for)
Renewable Dispatchable Firm Energy and)
Capacity)
_____)

HU HONUA BIOENERGY, LLC's POST-HEARING BRIEF

EXHIBITS "A" – "F"

AND

CERTIFICATE OF SERVICE

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Hu Honua Bioenergy, LLC, a Delaware limited liability company ("Hu Honua"), by and through its undersigned counsel, hereby submits its Post-Hearing Brief ("Brief") pursuant to Prehearing Conference Order No. 38188, issued by the Hawaii Public Utilities Commission ("Commission" or "PUC") on January 19, 2022.¹

I. INTRODUCTION.

Hu Honua would like to thank the Commission for the opportunity to appear before it at the Evidentiary Hearing ("Hearing") and appreciates the constructive input provided by all parties that helped Hu Honua to improve upon its plans and commitments to ensure a clean renewable energy project that will benefit the community for several decades to come. Hu Honua and its owners are committed to supporting the State's renewable energy and agricultural goals as a long-term partner and we humbly ask the PUC for its approval so such benefits/goals can be realized.²

While there's been a lot of testimony in this docket and at the Hearing on a number of different issues,³ the overwhelming and relevant evidence in the record establishes that the burden for approval has been met, and approval of the A&R PPA⁴ is appropriate. As the Commission is

¹ This Brief is timely filed pursuant to Commission's Order No. 38188, issued January 19, 2022.

² Hawaii Revised Statutes ("HRS") 5-7.5(b) (In exercising its power the Commission "may... give consideration to the 'Aloha Spirit').

³ While certain Parties and Participants have raised concerns relating to issues that were not appealed or addressed in Matter of Hawai'i Elec. Light Co., Inc. ("HELCO I"), 145 Hawai'i 1, 445 P.3d 673 (2019), including issues related to the total costs of the Project, the Hawaii Supreme Court ("Supreme Court" or "Court") has re-affirmed that HELCO I "explicitly delimited the purpose of the remand," requiring only that "the PUC shall give explicit consideration to the reduction of GHG emissions in determining whether to approve the A&R PPA, and make the findings necessary for this court to determine whether the PUC satisfied its obligations under HRS § 269-6(b)." See Matter of Hawai'i Elec. Light Co., Inc. ("HELCO II"), 149 Hawai'i 239, 242, 487 P.3d 708, 711 (2021).

⁴ Request for approval of (1) Amended and Restated Power Purchase Agreement dated May 5, 2017 between Hawaii Electric Light Company, Inc. ("HELCO") and Hu Honua; and (2) Hu Honua's request for preferential rates for the purchase of renewable energy produced in conjunction with agricultural activities pursuant to HRS § 269-27.3

aware, the Supreme Court limited the two remaining issues before the Commission on remand to: (1) afford Life of the Land (“LOL”) the opportunity to meaningfully participate in this docket with respect to its right to a clean and healthful environment as defined by HRS Chapter 269; and (2) expressly consider the reduction in greenhouse gas (“GHG”) emissions in connection with approving the A&R PPA pursuant to HRS § 269-6(b).⁵ Hu Honua submits that both of these issues have been addressed and satisfied in this remand proceeding, as it is undisputed that all Parties and Participants,⁶ including LOL, have been given the opportunity to meaningfully participate in this docket and at the Hearing, and co-applicants HELCO and Hu Honua have presented undisputed evidence demonstrating that Hu Honua’s state-of-the-art bioenergy facility (the “Project” or “Facility”) will significantly *reduce* GHG emissions over the 30-year term of the A&R PPA. In fact, the Project will not only reduce GHG emissions, but will also be the first utility-scale energy project in the State’s history to be *carbon negative* – in large part due to the comments and concerns brought by the parties and the community.

The Commission first approved the A&R PPA in 2017 on the basis that “[t]he purchased power costs and arrangements set forth in the A&R PPA appear reasonable, prudent, in the public interest, and consistent with HRS chapter 269 in general” In addition, the Commission stated that while it “finds the pricing to be reasonable, the commission makes clear that its decision to approve the A&R PPA is not based solely on pricing, but includes other factors such as the State’s need to limit its dependence on fossil fuels and mitigate against volatility in oil pricing.”⁷ The Commission’s rationale for approving the A&R PPA in 2017 is especially prescient given that the price of oil today has more than doubled since (July 2017 vs March 2022), and remains valid given that approximately 60% of HELCO’s electricity sales still consists of fossil fuel generation.⁸ Hu Honua’s purchased power costs and arrangements set forth in the A&R PPA have not changed since the prior approval,⁹ nor were they the subject of appeal by LOL, nor were their

(collectively, “A&R PPA”), filed May 9, 2017.

⁵ See HELCO I, 145 Hawai‘i at 26, 445 P.3d at 698; HELCO II, 149 Hawai‘i at 242, 487 P.3d at 711.

⁶ The Parties to this docket are HELCO, Hu Honua (collectively, “Applicants”), and Consumer Advocate (“CA”). The Participants are LOL and Tawhiri Power, LLC (“Tawhiri”). See Order No. 37852, fn. 1, filed June 30, 2021; see also Notice of Withdrawal of Hamakua Energy, LLC, filed January 12, 2022.

⁷ See Decision and Order No. 34726 (“2017 D&O”), issued July 28, 2017, at 60.

⁸ See Testimony (“Test.”) of Christopher Lau (“Mr. Lau”), Recording of Hearing (“ROH”), Hearing (“Hrg.”) Day 1, Mar. 1, 2022, at 02:51:16-02:51:49 (Mr. Lau stated re RPS Status Report, filed Feb. 8, 2022, Dkt. 2007-0008: “Yeah ... [Out of the 1,043,783 MWh sold to customers, approximately 600,000 MWh of energy sold to customers consisted of just fossil generation] sounds right. Yeah, that sounds right.”).

⁹ In 2017, HELCO’s bill impact analysis showed the average monthly bill impact being reduced by \$2.50; however,

reasonableness or prudence ever considered or addressed by the Supreme Court. Rather, the Court only indicated that the “hidden” cost associated with GHG emissions had not been sufficiently considered by the Commission pursuant to HRS § 269-6(b).

As a result, the relevant evidence presented in this docket and at the Hearing clearly demonstrates that Hu Honua and HELCO have met the burden required for the approval of the A&R PPA. LOL has been provided an opportunity to meaningfully participate with respect to its right to a clean and healthful environment as defined by HRS Chapter 269 (i.e., consideration given to reduction of GHG emissions)¹⁰ and the uncontroverted evidence establishes that GHG emissions will be significantly reduced. For these reasons alone, the A&R PPA should be approved.

Hu Honua has also heard and addressed the GHG emissions concerns raised during the first remand proceeding following HELCO I, including those raised by the Commission in its Order Denying Waiver that (1) a prior lifecycle GHG emissions analysis did not include biogenic emissions, (2) there were discrepancies in the assumptions used by Ramboll US Consulting, Inc. (“Ramboll”) and Environmental Resource Management (“ERM”), and (3) ERM had not compared Hu Honua’s smokestack emissions to a combination of fossil and renewable generation resources based on the long-term resource plan provided by HELCO.¹¹ All of these concerns have been addressed in this second remand proceeding following HELCO II. Indeed, Hu Honua has not only included detailed biogenic emissions in its lifecycle GHG emissions analysis, worked closely with HELCO to eliminate all discrepancies in assumptions, and assessed Hu Honua’s project emissions, including smokestack emissions, using the updated long-term resource plan provide by HELCO, which assumed a combination of fossil and renewable generation resources over the next 30 years – all of which demonstrates a significant *reduction* in GHG emissions, but it has also voluntarily committed, as a condition of approval, to be *carbon negative* (which means to offset more carbon, through sequestration, than emitted into the environment). Moreover, in the event the annual GHG

in 2021, HELCO re-did its bill impact analysis, in a way that makes it unreliable. The 2021 analysis assumed several different inputs as compared to the 2017 analysis, including using a low fuel price forecast from March 2021 (instead of a more recent forecast in 2022 reflecting oil pricing that has nearly doubled) and a different future resource plan that was over-resourced which resulted in Hu Honua being dispatched less, contributing to a projected average monthly bill increase.

¹⁰ See HELCO I, 145 Hawai‘i at 17, 445 P.3d at 689 (“[T]he private interest to be affected is LOL’s right to a clean and healthful environment, which ‘includes the right that explicit consideration be given to reduction of [GHG] emissions in Commission decision-making, as provided for in HRS Chapter 269.’”).

¹¹ See Order No. 37205, issued July 9, 2020, at 44-54.

inventory shows that Hu Honua was not carbon negative for a given year from 2035 or cumulatively over the 30-year term, Hu Honua has financially committed to either (1) purchase sufficient carbon offsets to make the GHG inventory carbon negative, or (2) pay a monetary amount for the purpose of procuring sufficient carbon offsets to meet its carbon negative commitments.¹²

Notwithstanding Hu Honua's unprecedented carbon negative commitments, which were offered as a condition of approval and were made without any request for increase in the pricing established in the A&R PPA, some of the questioning during the Hearing by the Commission seemed to raise concerns regarding the accountability of Hu Honua and the enforcement of such commitments. To ensure that Hu Honua's carbon negative commitments are realized, Hu Honua clarifies its commitments and agrees to supplementary conditions of approval that will enable the Commission to hold Hu Honua accountable and enforce such commitments. These proposed conditions, as mentioned during the Hearing and clarified during closing argument and this Brief, are as follows:

- Hu Honua agrees to place \$100,000 (or in the alternative, a range of up to \$450,000 if the Commission believes a higher amount is more appropriate) of "seed money", which may include marketable liquid assets, into a reserve fund or escrow account in Year 1 which will remain in the account for the entire 30 year A&R PPA term (or in the alternative, a lesser term if the Commission believes a lesser period of time is more appropriate) to serve as cushion of available funds to ensure that its carbon negative commitments are met. If there is any carbon sequestration deficit in the annual reporting to the PUC, Hu Honua will also place additional funds into the account each year over the 30-year term to cover the deficit and purchase carbon offsets (approximately \$15/ton);
- Hu Honua agrees to a condition requiring Hu Honua to provide a minimum of 3 prospective names of independent verifiers to the PUC, allow all parties to comment, then the PUC can approve which prospective names are qualified to perform the independent five-year verification, then Hu Honua will select the independent verifier from the PUC approved list;
- Hu Honua agrees to a condition that within 60 months after a final, non-appealable approval order from the PUC, Hu Honua will provide documentation to the PUC demonstrating that it has secured additional acreage on Hawaii Island to provide the feedstock for the remaining term of the A&R PPA;
- Hu Honua agrees not to receive a preferential rate for any period of energy generation using out-of-state feedstock; rather, Hu Honua would only be able to recover the Avoided Cost Rate as published monthly by HELCO for such period assuming such rate is lower than the A&R PPA rate;

¹² Hu Honua T-1, filed Sept. 16, 2021, at 32-33.

- Hu Honua agrees to all of the recommended conditions within Hu Honua's control described in Section II.F of the CA's Prehearing Statement of Position; and
- Hu Honua stipulates to ongoing review by the PUC for purposes of reviewing and enforcing Hu Honua's carbon negative commitments and any other commitments proffered by Hu Honua in this proceeding. If Hu Honua fails to meet any commitments, it agrees to cure any shortcomings within a reasonable period of time to ensure that Hu Honua's commitments are met.

In addition, in the event the above proposed conditions (further discussed in Section III.E) are insufficient or require further clarity for the Commission, Hu Honua agrees to adopt any reasonable modifications and/or additional conditions ordered by the Commission that will enable the Commission to hold Hu Honua accountable and enforce any conditions of approval. Hu Honua's offer to incorporate the above conditions of approval in its decision should provide sufficient assurance that the Project will be carbon negative and GHG emissions will be reduced.

As mentioned during closing argument, the Johnson Family expresses their deep gratitude for the opportunity to participate at the Hearing and has been involved in this Project for nearly a decade because they believe in the importance of the State's 100% renewable energy goal and want to be a partner in that.¹³ Hu Honua is far from perfect, but it is committed to improving and doing better. To that end, we have listened and learned from community feedback, concerns, and priorities and, while the terms of the A&R PPA remain the same, we have made significant adjustments and modifications to our operations that will result in a better and more inclusive Project that will go beyond just reducing GHG emissions (it will also be carbon negative), collaborating with the community to help rid undesirable invasive species, and creating opportunities for the production of green hydrogen fuels, amongst other things.

Hu Honua has endeavored to build this first-of-its-kind Facility, to not only bring clean renewable energy capable of replacing fossil fuel plants, but to utilize the significant agricultural activities and investment made by the community on the Hamakua Coast, where thousands of acres of commercial crops (Eucalyptus) have sat idle for decades, preventing benefits from being realized by the community. Hu Honua is an opportunity to revitalize East Hawaii Island's agricultural and forestry sector, bringing hundreds of jobs and infusing millions of dollars into the local economy over the next 30 years. In addition, Hu Honua will allow the use of woody invasive species as an additional (and optional) feedstock in supporting the State, County, HELCO, and

¹³ See Jennifer Johnson Letter, attached hereto as Exhibit A.

local landowners' efforts to remove such undesirable and harmful growth, as well as enable excess renewable energy to be used to create green hydrogen in support of the County's hydrogen efforts.

The same benefits previously recognized by the Commission are still benefits to be realized from the Project – “the Project provides the most viable opportunity to add firm, dispatchable, renewable generation in the near term” and “will provide performance and operational features similar to HELCO's existing [fossil] steam generators with dispatchable capacity, inertial and primary frequency response, regulation and load following capabilities,¹⁴ and will add to the diversity of HELCO's existing portfolio of renewable energy resources” while reducing fossil fuel generation and helping to meet the State's RPS, “without increasing the amount of as-available, intermittent renewable energy resources on HELCO's system.”¹⁵ Importantly, Hu Honua will also help to reduce oil price volatility, by stabilizing the cost of energy as it replaces fossil fuel generation,¹⁶ as well as reduce the cost of electricity as compared to fossil fuel generation.

Hu Honua has incurred to date approximately \$519 million in construction and development costs and the Project is now 99% complete. Further, the Project is supported by approximately 73% of Hawaii Island residents based on a recent public survey¹⁷ and, as of March 28, 2022, the docket reflects a total of 130 individuals who filed letters of support for the Project versus only 11 who filed letters indicating that they do not support the Project.¹⁸

As discussed herein, the record in this docket and evidence presented at the Hearing establishes that Hu Honua and HELCO have met the burden of proof required for approval of the A&R PPA.

¹⁴ Test. of Lisa Dangelmaier (“Ms. Dangelmaier”), ROH, Hrg. Day 2, Mar. 2, 2022, at 02:39:36-02:41:00.

¹⁵ See 2017 D&O, issued July 28, 2017, at 30, 31, and 56.

¹⁶ See HELCO response to CA/HELCO-SIR-28.a.1.(a) (“across the term of the PPA the vast majority of energy avoided/offset due to Hu Honua is from fossil fuels”); see also Test. of Dean Nishina (“Mr. Nishina”), ROH, Hrg. Day 3, Mar. 3, 2022, at 06:54:57-06:55:27 (“I agree that Hu Honua could facilitate [the retirement of HELCO's fossil fuel plants].”).

¹⁷ See Hu Honua Prehearing Statement of Position (“SOP”), attached hereto as **Exhibit B** (“SOP”), Exhibit 4, Hawaii Island Community Study, dated December 2021; see also Test. of Mr. Nishina, ROH, Hrg Day 3, Mar. 3, 2022, at 05:22:43-05:25:08.

¹⁸ See List of Hu Honua Supporters vs. Opponents (Public Comments filed, July 2, 2021 thru March 28, 2022), attached hereto as **Exhibit C**; see also Public Comment of Murray R. Clay, filed March. 8, 2021 (Murray R. Clay (“Mr. Clay”), President of Ulupono Initiative (“Ulupono”), believes “the Project [can] contribute to a more diverse and resilient renewable energy future for Hawaii Island”, “will complement Hawaii Island's current and future renewable energy portfolio, providing a low-carbon alternative for firm power generation,” and that Hu Honua's carbon negative commitments “represent a commitment to Hawaii and should be used as an example for future renewable energy projects, especially future biomass projects.”).

II. BACKGROUND.

A. 2013 and 2017 PUC Approvals.

In 2013, the Commission approved Hu Honua's original PPA for 21.5 MW with HELCO ("2013 Original PPA") at a levelized rate of approximately 25.3 cents/kwh over a 20-year term.¹⁹ Hu Honua expended approximately \$175 million in reliance on the 2013 Original PPA approval, which was never appealed.²⁰ In 2016, HELCO purported to terminate the 2013 Original PPA, which Hu Honua challenged, and HELCO ultimately agreed to rescind the termination and enter into the A&R PPA, dated May 5, 2017.²¹

In 2017, the Commission approved the A&R PPA, finding, in relevant part:

[T]he commission finds that the Project will provide performance and operational features similar to HELCO's existing steam generators with dispatchable capacity, inertial and primary frequency response, regulation and load following capabilities, and will add to the diversity of HELCO's existing portfolio of renewable energy resources. Stated succinctly, the Project will provide firm, dispatchable, renewable energy, and will provide ancillary services. ... As a firm, dispatchable biomass resource ... (1) the Project's fuel source is different than any other energy resource and is less vulnerable to weather- and climate-related reliability concerns, and (2) the Project adds another form of firm, dispatchable renewable energy with operational characteristics similar to HELCO'S existing fossil-fueled steam generators. ... [While the Commission] finds the pricing to be reasonable, the commission makes clear that its decision to approve the A&R PPA is not based solely on pricing, but includes other factors such as the State's need to limit its dependence on fossil fuels and mitigate against volatility in oil pricing.²²

In approving the A&R PPA, the Commission directed Hu Honua to work expeditiously to complete the Project by the Commercial Operations Date, ordering "Hu Honua and HELCO to make all reasonable attempts to complete the Project according to this schedule," without "future requests to extend the Commercial Operations Date deadline."²³ Hu Honua did just that, expending an additional \$315 million during the pendency of LOL's appeal (HELCO I), and another \$29 million in 2021, bringing the total Project costs to \$519 million and the Project is 99% complete.²⁴

¹⁹ Docket No. 2012-0212, Decision and Order No. 31758, issued Dec. 20, 2013, at 45-52; further details regarding the 2013 Original PPA approval are provided in the SOP, attached hereto as **Exhibit B**, at 3-4. Hu Honua hereby incorporates the entirety of the SOP as part of this Brief.

²⁰ See, SOP filed Dec. 21, 2022, attached hereto as **Exhibit B**, at 4.

²¹ HELCO T-1 at 5-7; see also Test. of Rebecca Dayhuff Matsushima ("Ms. Matsushima"), ROH, Hrg. Day 1, Mar. 1, 2022, at 02:06:05-02:06:26.

²² 2017 D&O, filed July 28, 2017, at 53-61.

²³ 2017 D&O, filed July 28, 2017, at 61.

²⁴ Hu Honua T-1, filed Sept. 16, 2021, at 6 ("At present, incurred Project development and construction costs and accrued interest total approximately \$519,461,000.").

Notwithstanding the important reasons the Commission articulated for approving the 2013 Original PPA and 2017 A&R PPA, including reducing the State’s reliance on fossil fuels and diversification of HELCO’s grid, LOL appealed the 2017 D&O to the Court on the basis that “the PUC failed to explicitly consider [GHG] emissions in determining whether to approve the A&R PPA, as required by state law [HRS § 269-6(b)].”²⁵

B. Hawaii Supreme Court Scope of Remand (HELCO I & HELCO II).

On May 10, 2019, the Supreme Court issued HELCO I holding, *inter alia*, that “the PUC erred by failing to explicitly consider the reduction of GHG emissions in approving the Amended PPA” pursuant to HRS § 269-6(b) and that “the PUC denied LOL due process with respect to the opportunity to be heard regarding the impacts that the Amended PPA would have on LOL’s right to a clean and healthful environment,” as defined by HRS Chapter 269.²⁶ The Court remanded the proceeding and ordered the Commission to “give explicit consideration to the reduction of GHG emissions in determining whether to approve the Amended PPA, and make the findings necessary for this court to determine whether the PUC satisfied its obligations under HRS § 269-6(b).”²⁷ The Commission failed to follow that instruction and Hu Honua appealed.

On May 24, 2021, following the Hawaii Supreme Court’s first remand of this matter in HELCO I, the Court re-affirmed and reiterated its instructions in HELCO II that “[o]n remand, the PUC shall give explicit consideration to the reduction of [greenhouse gas] emissions in determining whether to approve the A&R PPA, and make the findings necessary for this court to determine whether the PUC satisfied its obligations under HRS § 269-6(b).”²⁸ HELCO II also confirmed that “the court [in HELCO I] explicitly delimited the purpose of the remand” and that “[t]hese remand instructions circumscribed the scope of the attendant vacatur.”²⁹

C. HRS § 269-6(b), as Amended by Act 82.

On June 24, 2021, after the Court issued its opinion in HELCO II, HRS § 269-6(b) was amended by Act 82, as follows:

(b) The public utilities commission shall consider the need to reduce the State’s reliance on fossil fuels through energy efficiency and increased renewable energy generation in exercising its authority and duties under this chapter. In making

²⁵ HELCO I, 145 Hawai‘i at 2, 445 P.3d at 674.

²⁶ HELCO I, 145 Hawai‘i at 2-3, 445 P.3d at 674-675.

²⁷ HELCO I, 145 Hawai‘i at 25, 445 P.3d at 697 (emphasis in original).

²⁸ HELCO II, 149 Hawai‘i at 240, 487 P.3d at 709 (internal quotation marks omitted) (quoting HELCO I, 145 Hawai‘i at 25, 445 P.3d at 697) (emphases added).

²⁹ HELCO II, 149 Hawai‘i at 240, 487 P.3d at 709.

determinations of the reasonableness of the costs [of] pertaining to electric or gas utility system capital improvements and operations, the commission shall explicitly consider, quantitatively or qualitatively, the effect of the State's reliance on fossil fuels on ~~[price]~~ :

- (1) Price volatility ~~[, export]~~ ;
- (2) Export of funds for fuel imports ~~[, fuel]~~ ;
- (3) Fuel supply reliability risk ~~[, and greenhouse]~~ ; and
- (4) Greenhouse gas emissions.

The commission may determine that short-term costs or direct costs of renewable energy generation that are higher than alternatives relying more heavily on fossil fuels are reasonable, considering the impacts resulting from the use of fossil fuels. The public utilities commission shall determine whether such analysis is necessary for proceedings involving water, wastewater, or telecommunications providers on an individual basis.³⁰

Thus, the legislature clarified that the PUC's obligation under HRS § 269-6(b) is to consider the *reasonableness of the cost of renewable energy generation*, such as the Hu Honua Project, *against fossil fuel generation* (not against other renewable generation) given the impacts (i.e., price volatility, export of funds, fuel supply reliability risk, and GHG emissions) resulting from the use of fossil fuels.

D. Hu Honua's Objection to the Commission's Statement of Issues, as Modified by Order No. 37910.³¹

For the reasons discussed in the SOP attached hereto as **Exhibit B**, at 8-12, Hu Honua respectfully maintains its objection to the modified Statement of Issue No. 3, particularly as it relates to the consideration of "total costs", including "energy and capacity costs", where such non-GHG related costs were never at issue in HELCO I or HELCO II.

E. Evidentiary Hearing.

The Hearing was held on March 1-4, and 7, 2022, during which the Parties, Participants, and the Commission had a full opportunity to question all witnesses and develop the record so that the Commission could satisfy its statutory obligations under HRS § 269-6(b) (i.e., explicitly consider GHG emissions). The Hearing also satisfied LOL's right to a clean and healthful environment, as defined by HRS Chapter 269, as LOL was afforded an opportunity to cross-examine all witnesses. However, to Hu Honua's surprise given that LOL had appealed on the basis that GHG emissions were not considered pursuant to HRS § 269-6(b), LOL did not ask a single

³⁰ HRS § 269-6(b) (effective June 24, 2021); see also Gov. Msg. No. 1184 (June 24, 2021) available at https://www.capitol.hawaii.gov/session2021/bills/GM1184_.pdf (attaching Act 82).

³¹ Order No. 37910, issued Aug. 11, 2021.

question of Hu Honua's GHG witnesses, including Dr. David Weaver ("Dr. Weaver") of Environmental Resource Management ("ERM"), Braulio Pikman ("Mr. Pikman") of ERM, and Joshua Pearson ("Mr. Pearson") of JBP, LLC, regarding Hu Honua's Project GHG Emissions analysis. LOL also did not ask a single question of HELCO's GHG witnesses, including Dr. Abigail Kirchofer ("Dr. Kirchofer") of Ramboll US Consulting, Inc. ("Ramboll"), and Karin Kimura ("Ms. Kimura") of HELCO, regarding HELCO's Avoided Emissions GHG analysis.³²

The overwhelming evidence presented at the Hearing and in the record demonstrates that the Project will reduce GHG emissions on its own. Further, when factoring HELCO's avoided emissions from reduced fossil fuel generation, the net GHG emissions reduction of 1,464,742 metric tons ("MT") of CO₂e (that will be removed from the atmosphere) are substantial and unprecedented for a renewable energy project seeking the Commission's approval.

III. DISCUSSION.

A. The A&R PPA on Remand Should be Approved as GHG Emissions will be Reduced Over its 30-Year Term.

Statement of Issues Nos. 1., 1.a, and 2., as modified, provide:

1. What are the long-term environmental and public health costs of reliance on energy produced at the proposed facility?
 - a. What is the potential for increased air pollution due to the lifecycle GHG emissions of directly attributed the Project, as well as from earlier stages in the production process?
2. What are the GHG emissions that would result from approving the Amended PPA?³³

The evidence presented at the Hearing and in the docket demonstrate that the Project will significantly reduce GHG emissions over the 30-year term of the A&R PPA.³⁴ As established by the respective GHG analyses provided by Ramboll, on behalf of HELCO, and Hu Honua's consultant, ERM, the Project will result in a *Net Lifecycle GHG Emission Reduction* of 1,464,742 MT of CO₂e over the 30-year term of the A&R PPA. This total emissions reduction consists of

³² Although LOL was provided with the opportunity to question all of Hu Honua's witnesses, LOL only questioned Warren Lee ("Mr. Lee"), Hu Honua President, and declined to question the remaining witnesses, including Jon Miyata ("Mr. Miyata"), Hu Honua Director of Finance, Kevin Owen ("Mr. Owen"), Hu Honua General Manager, Dr. Weaver, Mr. Pikman, Mr. Pearson, Dr. Jonathan Jacobs ("Dr. Jacobs"), PA Consulting Group, and Bruce Plasch, Economist Consultant.

³³ Order No. 37910, issued Aug. 11, 2021, at 32-33

³⁴ See HELCO response to PUC-HELCO-IR-17.b, Att. 3 Ramboll GHG Analysis Report, filed Nov. 29, 2021, at 1-61, including ERM GHG Analysis and Table 13 attached thereto as Att. B.

the estimated *Avoided Lifecycle emissions*³⁵ of 1,434,243 MT CO₂e and estimated *Project Lifecycle GHG emissions* of -30,499 MT CO₂e.³⁶

Moreover, to ensure that the *Project Lifecycle GHG emissions* reduction projected by ERM is realized, Hu Honua has committed and agreed to, as a condition of approval of the A&R PPA, the Project being (1) at least 30,000 MT carbon negative cumulatively over the 30-year term of the A&R PPA (no matter the level of actual dispatch), and (2) carbon negative by the year 2035 and each year thereafter until the end of the PPA term (assuming operations allowed to begin in 2022).³⁷ As mentioned at the Hearing and clarified in its closing argument and this Brief, Hu Honua has agreed to supp. conditions of approval of the A&R PPA³⁸ that will enable the Commission to hold Hu Honua accountable and enforce its carbon negative commitments.

Accordingly, (1) the long-term environmental and public health costs of reliance on energy produced at the proposed facility will be non-existent or reduced; (2) the potential for increased air pollution due to the lifecycle GHG emissions of the Project will be reduced; and (3) the GHG emissions resulting from an approval of the A&R PPA will be reduced, thus enabling the Commission to approve the Project in satisfaction of its obligations under HRS § 269-6(b).

1. The Ramboll and ERM Project GHG Analyses, as well as Testimony at the Hearing, demonstrate that the Project will Reduce GHG Emissions.

In its updated November 2021 GHG analysis, Ramboll estimated the *Avoided Lifecycle GHG emissions* in the amount of 1,434,243 MT CO₂e by quantifying the projected GHG emissions that would result from the operation of HELCO system facilities with and without the Project,³⁹ which was not disputed by any party at the Hearing, including the CA's GHG witness, Michelle Daigle ("Dr. Daigle").⁴⁰ Ramboll's analysis accurately reflects the significant amount of

³⁵ According to Ramboll, "[a]voided GHG emissions represents emissions that would be avoided and would not be emitted to the atmosphere if the Project is approved and built."

³⁶ Accounting for all lifecycle stages such as raw materials and extraction, transportation, construction, operations & maintenance, and decommissioning & disposal, as well as boiler combustion emissions, carbon sequestration, harvesting equipment, site preparation, electricity use, transportation, fuel production, and production of fertilizer. With respect to GHG emissions in connection with decommissioning of the Project, ERM's GHG analysis provided overestimates of such emissions. Hu Honua plans to develop a decommissioning plan within 5 years of the end of the A&R PPA term.

³⁷ Hu-Honua T-1, filed Sept. 16, 2021, at 7, 27, and 29-31.

³⁸ See Section III.E, below.

³⁹ HELCO response to PUC-HELCO-IR-17.b, Att. 3 Ramboll GHG Analysis Report, filed Nov. 29, 2021, at 1-61. Given that this Avoided Lifecycle GHG emission analysis is for HELCO's production simulation dispatch (e.g. at approximately 11.8 MW), the avoided emissions for a higher dispatch would be even greater.

⁴⁰ Test. of Dr. Daigle, ROH, Hrg. Day 4, Mar. 2, 2022, at 2:22:49-2:23:09.

GHG emissions that will be avoided as a result of the Project. Further, the testimony of HELCO's GHG witnesses clarified that certain factors not considered in the Ramboll analysis may reflect an even greater increase in avoided emissions associated with the Project.

At the Hearing, Dr. Kirchofer and Ms. Kimura confirmed that Ramboll considered biodiesel avoided direct emissions as zero, and in turn, that if said emissions were not treated as zero this would potentially reflect an increase of avoided emissions with respect to the Project, furthering emissions reduction.⁴¹ Dr. Kirchofer also confirmed, subject to check, that the Ramboll GHG analysis did not explicitly account for upstream GHG emissions from prospective construction by HELCO or other existing fossil fuel facilities to retrofit to biodiesel operations, which she acknowledged that if accounted for, may result in a slight increase in avoided emissions compared to what is reflected in the Ramboll GHG analysis.⁴² Dr. Kirchofer further noted that "if the project were assumed to displace only fossil fuel electricity sources, or frankly, any mix of electricity that had a higher carbon intensity, then the avoided emissions would increase."⁴³ Dr. Kirchofer also confirmed her understanding that the Project would still reduce GHG emissions even if the *Avoided Lifecycle GHG emissions* were not accounted for given the findings of the ERM Project GHG analysis and Hu Honua's commitment to reducing emissions separate from any considerations of the avoided emissions due to displaced fossil fuel electricity.⁴⁴

The ERM Project GHG Analysis estimated the total *Project Lifecycle GHG emissions* in the amount of -30,499 MT CO₂e, which explicitly accounts for biogenic emissions associated with biomass supply and combustion and did not consider biomass as carbon neutral by default.⁴⁵ As the CA has acknowledged,⁴⁶ biogenic emissions are typically considered carbon neutral. However, Hu Honua held itself to a more exacting standard when it performed its detailed analyses and calculations to determine the GHG emissions from the Project's activities and use of biomass,

⁴¹ Test. of Dr. Kirchofer, ROH, Hrg. Day 2, Mar. 2, 2022, at 2:15:30-2:16:19; Test of Ms. Kimura, ROH, Hrg. Day 2, Mar. 2, 2022, at 1:58:06-1:59:35.

⁴² Test. of Dr. Kirchofer, ROH, Hrg. Day 2, Mar. 2, 2022, at 2:16:20-2:18:00

⁴³ Test. of Dr. Kirchofer, ROH, Hrg. Day 2, Mar. 2, 2022, at 2:19:29-2:19:44.

⁴⁴ Test. of Dr. Kirchofer, ROH, Hrg. Day 2, Mar. 2, 2022, at 2:20:19-2:20:54.

⁴⁵ HELCO response to PUC-HELCO-IR-17.b, Att. 3 Ramboll GHG Analysis Report, filed Nov. 29, 2021, at 1-61, including ERM GHG Analysis and Table 13 attached thereto as Att. B. Hu Honua also retained JBP, LLC ("JBP") to perform an analysis of the GHG emissions in connection with the construction of the Hu Honua facility. Discussion and/or conclusions from JBP's Construction Life Cycle Assessment, filed as Hu Honua T-6 and HU HONUA-601, are incorporated into ERM's GHG analyses for the Project.

⁴⁶ See CA's Errata to Its Statement of Position, filed Jan. 3, 2022, at pg. 32.

which will result in greater Project benefits.⁴⁷ Hu Honua has also created a carbon accounting process and a framework for reviewing and verifying actual GHG emissions as further described in ERM's Project GHG analysis.

As Dr. Weaver explained at the Hearing, the conservative nature of ERM's analysis, which overestimates the Project emissions and underestimates sequestration, will hold Hu Honua to a higher bar, and in reality will result in the Project negating even more emissions than what is reflected in the analysis.⁴⁸ While Dr. Daigle expressed concerns over certain calculations and assumptions in the ERM Project GHG Analysis,⁴⁹ she also testified that she did not disagree that the Project will be more than 30,000 MT CO₂e carbon negative over the A&R PPA term,⁵⁰ and that she did not have any criticism of ERM's accounting of the stack emissions from the Facility.⁵¹ Further, in response to questioning from Commissioner Jennifer M. Potter ("Commissioner Potter") regarding the accounting of sequestration from documented growth throughout the life of the tree, including prior to ownership and control of the tree, Dr. Kirchofer verified this is "an acceptable practice" through general project accounting standards, and in fact Ramboll's experts who focus on ecology and accounting for biomass verified that this is a "common practice."⁵² This confirms that Hu Honua's accounting for sequestration from its feedstock from the time it obtained ownership and control over said trees and prior to the Project being operational (from 2017 thru 2022) is not only appropriate, but also conservative, as it only accounts for sequestration from the time of ownership and control, but not prior to.

In consideration of the *Avoided Lifecycle GHG emissions* estimated in the Ramboll analysis and the *Project Lifecycle GHG emissions* estimated in the ERM analysis, the record establishes that the Project will result in a *Net GHG Lifecycle Emissions Reduction* in the amount of 1,464,742 MT of CO₂e, which represents carbon that will be removed from the atmosphere as a result of the Commission's approval of the A&R PPA.⁵³

Accordingly, with respect to Statements of Issue Nos. 1, 1.a., and 2: **Issue No. 1**, "*the long-term environmental and public health costs of reliance on energy produced at the proposed*

⁴⁷ See ERM Project GHG Analysis, at 33-63.

⁴⁸ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 5:04:49-5:05:45.

⁴⁹ Test. of Dr. Daigle, ROH, Hrg. Day 4, Mar. 4, 2022, at 2:24:22-2:25:19.

⁵⁰ Test. of Dr. Daigle, ROH, Hrg. Day 4, Mar. 4, 2022, at 5:48:03-5:48:50; see also *id.* at 4:43:46-4:44:24.

⁵¹ Test. of Dr. Daigle, ROH, Hrg. Day 4, Mar. 4, 2022, at 5:42:43-5:43:22.

⁵² Test. of Dr. Kirchofer, ROH, Hrg. Day 2, Mar. 2, 2022, at 2:28:30-2:30:30.

⁵³ HELCO response to PUC-HELCO-IR-17.b, Att. 3 Ramboll GHG Analysis Report, filed Nov. 29, 2021, at 1-61.

facility” will be non-existent or reduced given that the Project will *reduce* air pollution due to the reduced lifecycle GHG emissions of the Project, and will in turn improve the long-term environmental and public health; Issue No. 1.a., “*potential for increased air pollution due to the lifecycle GHG emissions of the Project*” will also be reduced given that the Project will *reduce* air pollution due to the reduced lifecycle GHG emissions of the Project; Issue No. 2., “*the GHG emissions that would result from approving the Amended PPA*” will also be reduced.

To ensure the reduction of GHG emissions and to carry out its carbon negative commitments, Hu Honua will, *inter alia*, plant and grow trees on leased properties (to the extent permitted by landowners) or through agreements and partnerships with local collaborators such as non-profit environmental organizations, including but not limited to, Friends of Hawaii Volcanoes National Park and One Tree Planted, as well as partners abroad such as the National Forest Foundation (“NFF”).⁵⁴ In addition, Hu Honua will document and verify its sequestration and emissions data by conducting an annual inventory and submitting to independent third-party verification every 5 years to ensure that its carbon negative commitments are met. In the event the GHG inventory shows that Hu Honua was not carbon negative for a given year beginning in 2035 or cumulatively over the 30-year A&R PPA term, Hu Honua has financially committed to either (1) purchase sufficient carbon offsets to make the GHG inventory carbon negative, or (2) pay a monetary amount for the purpose of procuring sufficient carbon offsets to achieve a carbon negative inventory.⁵⁵ As Dr. Weaver testified, Hu Honua’s annual accounting efforts will include measuring the actual growth of its trees to ensure its data is based upon real-time project-specific growth that will be verified every 5 years by an independent third-party verifier.⁵⁶ While ERM is confident in its assumptions and methodologies, Hu Honua is willing to incorporate any reasonable alternative assumptions or methodologies that the Commission prefers.⁵⁷

While Hu Honua established its carbon negative commitments in its pre-hearing testimony, Hu Honua also testified to its willingness to incorporate supplementary conditions that will enable the Commission to hold Hu Honua accountable and enforce such commitments to ensure that carbon reductions will be realized. Such proposed conditions are discussed in Section III.E, below.

⁵⁴ Hu Honua T-1, filed Sept. 16, 2021, at 31-32.

⁵⁵ Hu Honua T-1, filed Sept. 16, 2021, at 32-33.

⁵⁶ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:18:00-4:19:35.

⁵⁷ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:19:40-4:20:38; 4:31:08-4:31:43; see also SOP attached hereto as **Exhibit B**, at 19.

2. The Commission's concerns relating to Issues Nos. 1, 1.a, and 2 have been addressed.

At the Hearing, the Commission through its questioning expressed concerns over certain aspects of the Project and the mechanisms in place to hold Hu Honua accountable for its carbon negative commitments. Hu Honua submits that many of these concerns have been addressed by the supp. conditions provided in Section III.E, below. Hu Honua has also attempted to identify and address many of the concerns raised in **Exhibit D**. We discuss some of these concerns below.

For example, the Commission's questions over Hu Honua's current feedstock supply,⁵⁸ including the calculations of sequestration and emissions taken past the current lease terms,⁵⁹ are addressed by Hu Honua's agreement to secure additional acreage on Hawaii Island for the duration of the A&R PPA within 60 months of a final non-appealable order (well before its current 6-9 year feedstock supply runs out). Similarly, concern over the enforcement and accountability of the carbon negative commitments, including concern over the process of identifying an independent third-party verifier,⁶⁰ potential funding of carbon offsets, if needed,⁶¹ and stipulation to ongoing review by the Commission,⁶² have been addressed by the supp. conditions in Section III.E.

As to the concerns that may not have been directly addressed by the supp. conditions, Hu Honua submits that said concerns have also been addressed as follows.

- Potential use of invasive species as a feedstock source: Chair James P. Griffin ("Chair Griffin") raised concerns over whether there was sufficient information to determine whether other sources of feedstock such as invasive species would be used to fuel the Facility.⁶³ Mr. Lee stated in his testimony, Hu Honua could operate on just Eucalyptus Grandis feedstock, but his willingness to allow the use of invasive species as an additional (optional) fuel source is meant to be a benefit to the community to combat invasive species and maintain the island's native biodiversity as opposed to being placed in landfills and releasing carbon into the atmosphere with no benefit.⁶⁴ As Mr. Lee stated, this will involve partnerships and collaboration with the State, County of Hawaii, and HELCO.⁶⁵ GHG emissions associated

⁵⁸ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:23:23-7:23:40.

⁵⁹ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:21:17-4:21:56.

⁶⁰ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:34:37-7:35:01; see also Test. of Mr. Pikman, ROH, Hrg. Day 3, Mar. 3, 2022, at 1:01:55-1:02:20.

⁶¹ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:28:58-7:29:13; Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:31:30-7:31:55; Test. of Mr. Miyata, ROH, Hrg. Day 3, Mar. 3, 2022, at 00:25:05-00:26:03.

⁶² Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:50:28-7:51:06.

⁶³ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 8:08:46-8:10:05.

⁶⁴ Hu Honua T-1, filed Sept. 16, 2021, at 8.; see also Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 8:19:09-8:19:50 ("our primary feedstock is grandis eucalyptus, and we could operate on [just] grandis eucalyptus. But again, invasive species is a community benefit," explaining that use of invasive species is a community benefit).

⁶⁵ Hu Honua T-1, filed Sept. 16, 2021, at 8.

with invasive species use will be accounted for.⁶⁶

- Hu Honua's Accounting of Sequestration from NFF Trees: Commission Counsel Mark Kaetsu ("Mr. Kaetsu") asked Dr. Weaver questions regarding the assumptions used for NFF trees.⁶⁷ Dr. Weaver confirmed that the linear growth rate and inputs provided by NFF is based upon decades of experience from one of the most reputable foresting agencies.⁶⁸ Dr. Weaver also confirmed that even with these estimates, Hu Honua's annual inventories and five year independent third-party verification will ensure the accuracy of sequestration data, and to the extent these measurements differ from the estimates, Hu Honua will be able to account for this and adjust its sequestration accordingly to meet its carbon negative commitments.⁶⁹ Dr. Weaver further clarified that ERM's calculation of sequestration from NFF was very conservative, noting that Hu Honua has only taken credit for carbon sequestration for less than 500,000 MT, which excludes approximately 1,000,000 MT that would be sequestered from growth after the A&R PPA term using this linear approach.⁷⁰
- Local Sequestration Efforts: Mr. Kaetsu questioned Mr. Lee as to whether Hu Honua can provide assurances that replanting of trees would occur on Hawaii island or within the State of Hawaii, setting aside Hu Honua's testimony stating its intent to prioritize such.⁷¹ Hu Honua first notes that while trees planted or grown on Hawaii Island or the State will contribute to sequestration, so will trees that are planted and grown elsewhere, as sequestration of carbon has a global effect no matter the location of the planted trees.⁷² Notwithstanding, Hu Honua will prioritize local planting efforts on Hawaii Island or in the State such as the agreements it already has with The Friends of Volcanoes National Park and One Tree Planted, which will include the planting of native trees and plants.⁷³ Further, Mr. Lee testified to Hu Honua's willingness to consider any reasonable conditions that would allow for a minimum amount of sequestration to come from Hawaii Island or the State per year.⁷⁴
- Hu Honua's Accounting for Emissions related to Decommissioning: Mr. Kaetsu questioned Dr. Weaver as to whether Hu Honua will only decommission the retrofitted portions of the Facility.⁷⁵ Dr. Weaver stated that ERM's calculations of emissions relating to decommissioning were conservative and overestimated the emissions in any reasonable scenario, and also testified to Hu Honua's willingness to consider any reasonable alternative methodologies despite the relatively low emissions anticipated from decommissioning.⁷⁶

⁶⁶ See Hu Honua Response to CA/Hu Honua-IR-125.b, d, filed Nov. 18, 2021, at 40-41; see also Hu Honua response to CA/Hu Honua-SIR-31.a.1, filed Nov. 18, 2021, at 15.

⁶⁷ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:37:48-4:38:04.

⁶⁸ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:39:10-4:39:33; see also *id.* at 4:43:07-4:43:44.

⁶⁹ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:38:04-4:38:51; see also *id.* at 4:43:41-4:44:18.

⁷⁰ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:39:46-4:40:59.

⁷¹ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:18:30-7:19:00.

⁷² Hu Honua response to CA/Hu Honua-IR-122, filed Oct. 21, 2021, at 28.

⁷³ See Hu Honua T-1, filed Sept. 16, 2021, at 31; Hu Honua-202, Hu Honua 203, filed Sept. 16, 2021.

⁷⁴ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:20:29-7:21:00.

⁷⁵ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:30:04-4:30:16.

⁷⁶ Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:30:16-4:31:47; see also Odeh, Timothy T. Cockerill, Lifecycle analysis of UK coal fired plants, attached as Exhibit 3 to Hu Honua's response to PUC-Hu Honua-IR-15, filed Oct. 28, 2021.

- **Familiarity with Reputable Carbon Offset Program:** Commissioner Potter questioned Mr. Pikman, about how Hu Honua will select a reputable carbon offset program.⁷⁷ Mr. Pikman clarified that carbon offsets would only be used as a last resort, and that there is no certainty as to whether Hu Honua will need to purchase carbon offsets to meet its carbon negative commitments.⁷⁸ Regardless, Mr. Pikman testified to his familiarity of the many reputable sources of carbon offsets that Hu Honua could select to purchase from, including high quality nature-based solution projects that would plant native forest species, which ERM would advise Hu Honua to pursue.⁷⁹
- **Recipient of Payment for Procuring Sufficient Carbon Offsets:** Mr. Kaetsu questioned Mr. Lee regarding who Hu Honua intends to pay a monetary amount to for the purpose of procuring sufficient carbon offsets to achieve a carbon negative GHG inventory if the need to do so ever arose.⁸⁰ Mr. Lee testified that one option would be for Hu Honua to partner with the State of Hawaii Department of Land and Natural Resources (“**DLNR**”) and to pledge a monetary amount towards their 100 Million Tree Program to contribute to their planting efforts and in turn contribute towards Hu Honua’s carbon commitments, which he noted was one of many ways to “keep the money and keep the trees in the State of Hawaii.”⁸¹

3. **Other Parties/Participants’ concerns relating to Issues Nos. 1, 1.a, and 2 have been addressed.**

Parties and Participants raised concerns related to Issue Nos. 1, 1.a, and 2 through questioning of Hu Honua’s witnesses at the Hearing, many of which have been addressed through the evidence presented at the Hearing and in the docket, and the supp. conditions provided in Section III.E. Hu Honua has also attempted to identify and address many of the concerns raised in **Exhibit D**. We discuss some of these concerns below.

Mr. Nishina, Executive Director of the CA, testified that while the CA has raised questions and concerns about the Project and its potential impact on the consumers, it is not necessarily opposed to the Project itself.⁸² Hu Honua submits that the supp. conditions in Section III.E, below, address the CA’s questions and concerns relating to Project GHG emissions, including its concerns relating to Hu Honua’s feedstock supply and potential for importing out-of-state feedstock.⁸³

Further, while Dr. Daigle, who admits did not conduct an independent GHG analysis⁸⁴ and lacks professional experience performing a quantitative or qualitative analysis of GHG

⁷⁷ Test. of Mr. Pikman, ROH, Hrg. Day 3, Mar. 3, 2022, at 1:01:55-1:02:20.

⁷⁸ Test. of Mr. Pikman, ROH, Hrg. Day 3, Mar. 3, 2022, at 1:02:20-1:02:40.

⁷⁹ Test. of Mr. Pikman, ROH, Hrg. Day 3, Mar. 3, 2022, at 1:02:40-1:06:42.

⁸⁰ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:42:45-7:43:14.

⁸¹ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:43:14-7:45:01.

⁸² Test. of Mr. Nishina, ROH, Hrg. Day 3, Mar. 3, 2022, at 05:28:27-05:29:48.

⁸³ Test of Dr. Daigle, ROH, Hrg. Day 4, Mar. 4, 2022, at 2:39:17-2:39:56.

⁸⁴ Test. of Dr. Daigle, ROH, Hrg. Day 4, Mar. 4, 2022, at 2:20:12-2:20:34.

emissions,⁸⁵ raised concerns with certain assumptions used in the ERM Project GHG analysis, her concerns were not necessarily related to any flaw in the methodologies or calculations, but rather were related to uncertainty over whether “the plan is going to go according to plan.”⁸⁶ Dr. Daigle further stated that she did not dispute the methodologies in Ramboll’s GHG analysis,⁸⁷ which shows the Project will result in 1,434,243 MT CO₂e in *Avoided Lifecycle GHG emissions*, and that she did not disagree that the Project will be more than 30,000 MT carbon negative.⁸⁸ Such testimony indicates that Dr. Daigle and the CA’s concerns were limited to assumptions used to quantify certain data in the ERM Project GHG Analysis, which Dr. Weaver testified would be addressed annually by measuring actual emissions and increasing sequestration if necessary, and did not dispute ERM’s conclusion that the Project will significantly reduce GHG emissions.

Though all Parties and Participants were given an opportunity to question Hu Honua’s GHG witnesses only the CA opted to question these witnesses.⁸⁹ None of the Parties or Participants have offered alternative methodologies or analyses that provide a more accurate accounting of the *Project Lifecycle emissions*. Instead, the record is clear that Hu Honua performed a comprehensive lifecycle emissions analysis that considers, *inter alia*,⁹⁰ harvesting, planting fertilizer, land use change, soil organic carbon, ash transportation, off-island emissions, and embodied emissions associated with fuel and fertilizer, that will ensure the realization of Hu Honua’s carbon negative commitment.

B. The A&R PPA on Remand Should be Approved as (1) the Cost Associated with GHG Emissions is Reasonable; (2) the “Total Costs” Are Reasonable; and (3) HRS § 269-27.3 Allows for Preferential Rates.

The evaluation of costs in this proceeding must be guided and constrained by HELCO I and HELCO II, which limited the issues on remand within the context of GHG emissions under HRS § 269-6(b) by instructing:

On remand, the PUC shall give explicit consideration to the reduction of GHG emissions in determining whether to approve the Amended PPA, and make the findings necessary for this court to determine whether the PUC satisfied its

⁸⁵ Test of Dr. Daigle, ROH Hrg. Day 3, Mar 4, 2022, at 2:26:24-2:26:52; 2:31:16-2:32:55.

⁸⁶ Test. of Dr. Daigle, ROH, Hrg. Day 4, Mar. 2, 2022, at 2:24:22-2:26:07.

⁸⁷ Test. of Dr. Daigle, ROH, Hrg. Day 4, Mar. 2, 2022, at 2:22:49-2:23:09.

⁸⁸ Test. of Dr. Daigle, ROH, Hrg. Day 4, Mar. 2, 2022, at 05:48:03-05:48:50; see also id. at 4:43:46-4:44:24.

⁸⁹ With the exception of Mr. Pearson, who was not questioned at the Hearing.

⁹⁰ Considers all lifecycle stages such as raw materials and extraction, transportation, construction, operations & maintenance, and decommissioning & disposal, as well as boiler combustion emissions, carbon sequestration, harvesting equipment, site preparation, electricity use, transportation, fuel production, and production of fertilizer.

obligations under HRS § 269-6(b).”⁹¹

In order to comply with statutory and constitutional requirements, the PUC's post-remand hearing must afford LOL an opportunity to meaningfully address the impacts of approving the Amended PPA on LOL's members' right to a clean and healthful environment, as defined by HRS Chapter 269. The hearing must also include express consideration of GHG emissions that would result from approving the Amended PPA, whether the cost of energy under the Amended PPA is reasonable in light of the potential for GHG emissions, and whether the terms of the Amended PPA are prudent and in the public interest, in light of its potential hidden and long-term consequences.⁹²

The Court in HELCO I explained that consideration of “the reasonableness of the energy charges implicated by the Amended PPA, and to determine whether the arrangement was prudent and in the public interest” ... “would necessarily include an evaluation of the hidden and long term costs of the activities of the Hu Honua facility,” which “require[s] consideration of the GHG emissions generated by the Hu Honua facility,” which the Commission had failed to do in the 2017 D&O.⁹³ Thus, it is clear that the consideration of “costs” in this remand proceeding is limited to the “hidden and long-term costs” associated with “GHG emissions” within the context of HRS § 269-6(b).⁹⁴

While Statement of Issue No.3, as modified, provides

3. Whether the total costs of energy under the Amended PPA including but not limited to the energy and capacity costs is are reasonable in light of the potential for GHG emissions.⁹⁵

Hu Honua respectfully submits that the Court’s remand instructions to the Commission only contemplated consideration of the reasonableness of the A&R PPA cost “in light of the potential for GHG emissions” – i.e., the reasonableness of the cost associated with or attributable to GHG emissions – and given that GHG emissions will be reduced, there will be a reduction in cost associated with GHG emissions.⁹⁶ Though it disagrees, Hu Honua understands that the Commission’s interpretation of HELCO I is that the Supreme Court considered the costs of the A&R PPA “as a whole, without specific emphasis on any particular component, such as the energy

⁹¹ See HELCO I, 145 Hawaii at 25, 445 P.3d at 697; see also HELCO II, 149 Hawai‘i at 7 (emphases added).

⁹² HELCO I, 145 Hawai‘i at 26, 445 P.3d at 698 (emphasis added); see also HELCO II, 149 Hawaii at 9.

⁹³ HELCO I, 145 Hawai‘i at 17, 445 P.3d at 689 (emphasis added).

⁹⁴ See HELCO II, 149 Hawai‘i at 241, 487 P.3d at 710 (“The “true intent and meaning” of a reviewing court’s mandate is not to be found in a solitary word or decontextualized phrase, but rather in the opinion, as a whole, read in conjunction with the judgment and interpreted in light of the case’s procedural history and context.”).

⁹⁵ Order No. 37910, issued Aug. 11, 2021, at 32-33.

⁹⁶ The Court in HELCO I and HELCO II never addressed “total costs”, “energy and capacity costs”, or any other cost consideration not directly related to “the potential for GHG emissions,” nor were such costs raised on appeal and, thus, are deemed waived.

charge” (even though the “energy charge” was never raised on appeal or considered by the Court), and that HRS § 269-6(b) requires the Commission to determine the “reasonableness of the costs of utility system capital improvements and operations,” including the A&R PPA’s “total costs”⁹⁷ (even though the Court had only focused on the GHG emissions component of HRS § 269-6(b) and the only type of cost addressed by the Court were the “hidden and long-term costs” associated with GHG emissions).

Even if the determination of the reasonableness of the A&R PPA’s “total costs” is an appropriate issue on remand, such costs should still be confined with the context of HRS § 269-6(b) which obligates the PUC, in making determinations of the reasonableness of the costs pertaining to electric utility system capital improvements and operations, such as Hu Honua’s A&R PPA, to consider the effect of the State’s reliance on *fossil fuels* on: (1) price volatility; (2) export of funds for fuel imports; (3) fuel supply reliability risk; and (4) greenhouse gas emissions.

The evidence presented at the Hearing and this docket supports the reasonableness of the cost associated with GHG emissions, as well as the A&R PPA’s “total costs” including “energy and capacity costs” pricing, within the context of HRS § 269-6(b), which allows the PUC to determine that renewable energy costs that are higher than fossil fuel alternatives are reasonable. Moreover, even if the Commission finds Hu Honua’s costs are higher than market pricing, HRS § 269-27.3 allows for preferential rates, thus enabling the Commission to approve the Project.⁹⁸

1. The Cost of the A&R PPA Associated with GHG Emissions is Reasonable “in Light of the Potential GHG Emissions”.

For the reasons discussed herein and in the SOP attached hereto as **Exhibit B**, at 21-23, Hu Honua will reduce the cost associated with GHG emissions. Dr. Jacobs computed the dollar value of Hu Honua’s emissions reduction based on results from HELCO’s emissions analysis, which Ramboll derived from the dispatch levels reported by HELCO in the 2021 Puako-out scenario.⁹⁹ Based on that computation, the A&R PPA will reduce GHG emissions related costs by \$96 million -- costs that would otherwise be imposed by the GHG emissions of other fossil generators. Dr. Jacobs also calculated the dollar value of Hu Honua’s emissions reduction based on a full

⁹⁷ Order No. 37936, issued Aug. 27, 2021, at 10-12.

⁹⁸ Hu Honua T-1, filed Sept. 16, 2021, at 18-22.

⁹⁹ The Commission directed HELCO to “run additional production simulations for the Base and Alternate Cases using an updated set of resource plans with Puako Solar removed.” See PUC-HELCO-IR-17.a., filed Nov. 12, 2021, at 1. In this Brief, “Puako Out” refers to scenarios where Puako Solar has been removed.

Committed Capacity dispatch, which results in a further reduction in GHG emissions costs to an amount of \$132 million. This represents a total benefit (cost savings) of between \$96 million to \$132 million “in light of the potential for GHG emissions.”¹⁰⁰

All other Parties and Participants testified that they did not consider or evaluate the Project’s costs associated with GHG emissions.¹⁰¹ Thus, only Hu Honua has presented evidence regarding the cost associated with GHG emissions. Given that the cost associated with Hu Honua’s GHG emissions reduction results in a savings, Hu Honua submits that the cost “in light of the potential for GHG emissions” is reasonable.

2. Total Costs of the A&R PPA, including Energy and Capacity Costs, Are Reasonable “in Light of the Potential for GHG Emissions”.

For the reasons discussed herein and in the SOP attached hereto as **Exhibit B**, at 23-39, assuming the determination of the reasonableness of the “total costs” of the A&R PPA is an appropriate issue on remand, such determination must be guided and constrained by the express statutory requirements of HRS § 269-6(b). Under the clear and unambiguous language of HRS § 269-6(b), as amended by Act 82,¹⁰² the Commission

... shall consider the need to reduce the State’s reliance on fossil fuels through ... increased renewable energy generation ... [and] [i]n making determinations of the reasonableness of the costs pertaining to electric ... utility system capital improvements and operations, the [PUC] shall explicitly consider, quantitatively or qualitatively, the effect of the State’s reliance on fossil fuels on:

- (1) Price volatility;
- (2) Export of funds for fuel imports;
- (3) Fuel supply reliability risk; and
- (4) Greenhouse gas emissions.

The [PUC] may determine that short-term costs or direct costs of renewable energy generation that are higher than alternatives relying more heavily on fossil fuels are reasonable, considering the impacts resulting from the use of fossil fuels.

Thus, the legislature in Act 82 clarified that the PUC’s obligation under HRS § 269-6(b) is to

¹⁰⁰ See SOP, **Exhibit B**, at 22-23 (citing Hu Honua-701, filed Sept. 16, 2021) and Exh. 2; see also Resp. to PUC-Hu Honua-IR-42.a.

¹⁰¹ Test. of Robert Uyeunten (“Mr. Uyeunten”), ROH, Hrg. Day 1, Mar. 1, 2022, at 07:20:42-07:20:52 (“No [Uyeunten did not analyze the incremental cost associated with GHG emissions in his analysis], because we don’t have an established cost per GHG.”); Test. of Donald Gruenmeyer (“Mr. Gruenmeyer”), ROH, Hrg. Day 4, Mar. 4, 2022, at 00:45:00-00:45:23 (“No, I did not [attempt to assess the value or the cost of GHG emissions]. . . . That was not within my scope.”); Test. of Steve Pace, ROH, Hrg. Day 5, Mar. 7, 2022, at 00:18:08-00:18:26 (“No [Tawhiri did not consider the cost of GHG emissions associated with burning fossil fuel], our focus was not on the greenhouse gas analysis, per se.”); Test. of Henry Curtis, ROH, Hrg. Day 4, Mar. 4, 2022, at 06:55:21-06:55:41 (“No [neither Henry Curtis nor LOL conducted any of its own studies with respect to the Project’s greenhouse gas impacts].”).

¹⁰² HRS § 269-6(b) (effective June 24, 2021) (emphasis added).

consider the *reasonableness of the cost of renewable energy generation*, such as the Hu Honua project, *as compared to fossil fuel generation* (not against other renewable generation) given the impacts of fossil fuels on (1) price volatility, (2) export of funds for fuel imports, (3) fuel supply reliability risk, and (4) GHG emissions. Hu Honua pricing consultant, Dr. Jacobs, evaluated the reasonableness of Hu Honua's pricing in the context of HRS § 269-6(b), as amended.¹⁰³

With respect to price volatility, Hu Honua provides valuable insurance against fossil fuel price variability and variance of prices from forecasts. Hu Honua's cost is prescribed in the A&R PPA and, therefore, it will not swing with fossil fuel prices. As a result, Hu Honua will reduce the price volatility of energy costs.¹⁰⁴ Oil prices by nature can be very uncertain or volatile, and such inherent volatility and variability of oil prices creates risk for consumers.¹⁰⁵ The cost of a renewable resource with predictable pricing – even if higher than the current cost of a fossil fueled resource – may be reasonable to avoid the danger of volatile pricing spikes. All other Parties and Participants testified that they did not consider or evaluate fossil fuel price volatility.¹⁰⁶

With respect to the export of funds for fuel imports, Hu Honua again provides valuable insurance against having to export funds to pay for fossil fuel imports. As Hu Honua stated several times throughout this proceeding, Hu Honua desires and intends to source all of its biomass locally in Hawaii as its primary feedstock will consist of locally available eucalyptus.¹⁰⁷ Sourcing feedstock locally will also keep costs down and will support keeping jobs on Hawaii Island.¹⁰⁸ As a result, Hu Honua will reduce the export of funds for fuel imports. All other Parties and Participants testified that they did not consider or evaluate export of funds for fuel imports.¹⁰⁹

¹⁰³ Hu Honua T-7, filed Sept. 16, 2021, at 3-4; Exhibit HU HONUA-701, filed Sept. 16, 2021, as updated in the SOP, **Exhibit B**; as further updated in Hu Honua Supp. Response to PUC-Hu Honua-IR-41, filed Dec. 30, 2021.

¹⁰⁴ See Test. of Mr. Uyeunten, ROH, Hrg. Day 1, Mar. 1, 2022, at 07:28:27-07:28:33 (“Hu Honua will reduce [HELCO’s] exposure to fossil fuel price volatility.”).

¹⁰⁵ *Id.*, Hrg. Day 2, Mar. 2, 2022, at 01:43:45-01:44:25 (“[C]ustomer bills do change each month because of the cost of fuel. So, by lessening customer’s exposure to an amount of the quantity of fossil fuel and then therefore the varying price of that quantity of fossil fuel, then yeah, bills could be stabilized.”).

¹⁰⁶ See Test. of Mr. Uyeunten, ROH, Hrg. Day 1, Mar. 1, 2022, at 07:18:46-07:20:04 (“No [I did not analyze fuel price volatility].”); Test. of Mr. Gruenemeyer, ROH, Hrg. Day 4, Mar. 4, 2022, at 00:43:16-00:44:01 (“I was not asked to look at price volatility.... I didn’t look at price volatility.”); Test. of Mr. Pace, ROH, Hrg. Day 5, Mar. 7, 2022, at 00:47:02-00:48:32 (“No [Tawhiri did not analyze the Hu Honua project’s impact on fossil fuel price volatility].”).

¹⁰⁷ See Hu Honua Response to LOL-IR-2021-10, LOL-IR-2021-48(b), filed Oct. 21, 2021, at 70; Hu Honua T-1, filed Sept. 16, 2021, at 15-17; Hu Honua T-2, filed Sept. 16, 2021, at 4; and Hu Honua Response to PUC-Hu Honua-IR-26(d), filed Oct. 29, 2021, at 33.

¹⁰⁸ Hu Honua T-2, filed Sept. 16, 2021, at 4.

¹⁰⁹ See Test. of Mr. Uyeunten, ROH, Hrg. Day 1, Mar. 1, 2022, at 07:20:05-07:20:13 (“No [I did not analyze the export of funds for fuel imports].”); Test. of Mr. Gruenemeyer, ROH, Hrg. Day 4, Mar. 4, 2022, at 00:44:01-00:44:16 (“I did not [look at export of funds for fuel imports as part of my analysis].”); Test. of Mr. Pace, ROH, Hrg. Day 5,

With respect to the fuel supply reliability risk, Hu Honua again provides valuable insurance against fossil fuel supply reliability risk. Similar to fossil fuel generation, Hu Honua will provide true-firm dispatchable energy available 24/7 year-round, except because the biomass fuel source is abundant and locally available, the risk of biomass fuel supply is lower than that of fossil fuel that must be imported by ship into Hawaii and is subject to global shortages.¹¹⁰ As a result, Hu Honua will reduce fuel supply reliability risk. An added benefit of having a locally available fuel supply that can generate true-firm 24/7 renewable energy is that it also reduces reliability risk as compared to variable renewable resources, such as intermittent (weather-dependent) solar or wind, and solar paired with semi-firm storage.¹¹¹ All other Parties and Participants testified that they did not consider or evaluate fuel supply reliability risk.¹¹²

With respect to the GHG emissions, as discussed above, Hu Honua will reduce the cost associated with GHG emissions by avoiding fossil fuel GHG emissions as well as reducing GHG emissions as part of its operations. Moreover, Hu Honua has made a carbon negative commitment to ensure that GHG emissions will not only be reduced, but also negative. As a result, Hu Honua will reduce the cost associated with GHG emissions.¹¹³ All other Parties and Participants testified that they did not consider or evaluate costs associated with GHG emissions.¹¹⁴

In addition, while HRS § 269-6(b) also allows the Commission to determine that short-term costs or direct costs of renewable energy generation that are higher than alternatives relying more heavily on fossil fuels are reasonable, considering the impacts resulting from the use of fossil fuels, the evidence demonstrates that when Hu Honua is evaluated against the cost of fossil fuel, Hu Honua is projected to be less costly than fossil fuel generation and will result in a savings to

Mar. 7, 2022, at 00:47:34-00:48:12 (“No [Tawhiri did not analyze the export of funds for fossil fuel imports].”).

¹¹⁰ See Test. of Mr. Nishina, ROH, Hrg. Day 3, Mar. 3, 2022, at 02:59:23-02:59:35 (“In general, yes [a project that relies on locally harvested feedstock will reduce the risk associated with importing fossil fuels].”).

¹¹¹ See Test. of Mr. Nishina, ROH, Hrg. Day 3, Mar. 3, 2022, at 06:53:50-06:54:06 (“[W]ith sufficient feedstock, Hu Honua could be dispatched on a 24-hour basis as compared to a storage that may only have, say, sufficient capacity to be run at for four hours, for example.”); See also Test. of Ms. Dangelmaier, ROH, Hrg. Day 2, Mar. 2, 2022, at 02:45:08-02:46:30 (“[T]he steam units tend to have a high inertia, which results in a lower rate of change of frequency for imbalances, and that’s positive....The other advantage worth noting for Hu Honua would be that, similar to geothermal, it’s a dispatchable, firm renewable, and not variable. It’s not a finite energy resource, like a storage”).

¹¹² See Test. of Mr. Uyeunten, ROH, Hrg. Day 1, Mar. 1, 2022, at 07:20:14-07:20:21 (“No [I did not analyze fuel supply reliability risk].”); Test. of Mr. Gruenemeyer, ROH, Hrg. Day 4, Mar. 4, 2022, at 00:44:17-00:44:40 (“No, [my analysis did not take into account fuel supply reliability risk,] it was just production simulation results.”); Test. of Mr. Pace, ROH, Hrg. Day 5, Mar. 7, 2022, at 00:48:13-00:48:42 (“No [Tawhiri did not analyze fossil fuel supply reliability risk in connection with the Hu Honua project].”).

¹¹³ See discussion *supra* Section III.B.1.

¹¹⁴ See fn 101, *supra*.

ratepayers. Dr. Jacobs prepared a summary of bill impacts based on HELCO's production simulation projected dispatch (with Puako-out) which shows an average monthly bill impact of -\$1.13 (a savings to ratepayers), and at full dispatch, an average monthly bill impact of -\$8.31 (a savings to ratepayers).¹¹⁵ No Party or Participant to this proceeding disputes with particularity any specific findings in Dr. Jacobs' analysis. HELCO admits it has not performed an assessment or analysis of Dr. Jacobs analysis, including Hu Honua's displacement of existing fossil fuel plants.¹¹⁶ In addition, in March 2022, HELCO's Avoided Energy Cost is 21 cents/kwh and Energy Cost Recovery is 23 cents/kwh (also showing HEP's fossil energy at 26.448 cents/kwh).¹¹⁷ As a result, the "total costs" under the A&R PPA in the context of HRS § 269-6(b) are reasonable.

HELCO also performed a bill impact analysis; however, such analysis is not reliable given that it was not done in the context of HRS § 269-6(b), nor did it evaluate the cost of Hu Honua against just fossil generation. Rather, it made assumptions 30 years into the future regarding other renewable resources that do not yet exist,¹¹⁸ assumed existing resources will be extended beyond their current contract terms,¹¹⁹ and assigned speculative pricing to such fictitious resources.¹²⁰ HELCO's analysis is also not reliable because it relies an outdated low fuel price forecast from March 2021, and assumes no future pricing spikes.¹²¹ The March 2021 fuel price forecast is the lowest seen in this docket, its predecessor docket, or the PSIP docket since 2014¹²² and was

¹¹⁵ Hu Honua Supplemental Response to PUC-Hu Honua-IR-41, filed Dec. 30, 2021, at 3, Tables 1 and 2, top, far right column.

¹¹⁶ See HELCO response to CA/HELCO-SIR-28.a.1.

¹¹⁷ See Test. of Mr. Pace, ROH, Hrg. Day 5, Mar. 7, 2022, at 00:51:55-00:52:37 ("[21 cents/kwh] is [HELCO's] avoided [energy] cost [for March 2022], that is not what Tawhiri gets paid. ... Yes [HELCO's avoided energy cost increases when the cost of oil goes up]. ... Yes [Hu Honua's energy pricing is fixed or predetermined under the PPA]."); https://www.hawaiianelectric.com/documents/billing_and_payment/rates/avoided_energy_cost/avoid_ener_gy_cost_table.pdf; https://www.hawaiianelectric.com/documents/billing_and_payment/rates/energy_cost_adjustmen_t_filings/hawaii/2022/hawaii_ecrc_2022_03.pdf.

¹¹⁸ See Test. of Mr. Uyeunten, ROH, Hrg. Day 1, Mar. 1, 2022, at 06:32:25-06:32:31 ("[T]he resource expansion model added some proxy units in there."); HELCO-301, Att. 2 to Response to PUC-HELCO-IR-17, filed Nov. 22, 2021, at 1 (Updated Resource Plans showing hypothetical resources between 2025-2050).

¹¹⁹ HELCO's 2017 bill impact analysis that supported the approval of the A&R PPA in the 2017 D&O did not assume contracts beyond their current project terms; in contrast, HELCO's 2021 bill impact analysis assumed the extension and continued operation of several other projects beyond their current terms such as Wailuku River Hydro past 2023; Puna Geothermal Ventures past 2024; Tawhiri past 2027; and HEP past 2030. HELCO's assumption that these projects would continue operating past their PPA terms is in conflict with the Commission's practice to consider bill impact analyses that assume facilities through the end of their PPA terms because such terms are known and the costs can be reasonably estimated.

¹²⁰ See Test. of Mr. Uyeunten, ROH, Hrg. Day 1, Mar. 1, 2022, at 06:59:38-06:59:45 ("All future units used proxy prices.").

¹²¹ See HELCO T-3, filed Sept. 16, 2021, at 4 ("Fuel prices were updated to Hawaii Electric Light's March 2021 fuel price forecast. Refer to HELCO-302 for fuel prices used in the analysis.").

¹²² Compare HELCO T-3 Exhibit HELCO-302, filed Sept. 16, 2021, with HELCO T-3 Exhibit HELCO-302 filed Jan.

developed in the middle of the COVID-19 pandemic when fossil fuel demand was low. It is commonly known that disruptions in supply cause substantial spikes in pricing, yet no sensitivity analyses were performed by HELCO or the CA's expert on this low fossil-fuel price forecast.¹²³ Given the testimony, it would be prudent for the PUC to request a sensitivity analysis using, *inter alia*, a more recent fuel price forecast which would reveal the impacts of oil price volatility and sharply increasing fossil fuel prices, especially given that the price of oil has nearly doubled in March 2022 due in part to the rebound of the global economy, changes in Federal energy policy, the Russia-Ukraine conflict,¹²⁴ and other factors.¹²⁵ As Mr. Uyeunten admits in his Prehearing Testimony: "Updates to fuel price forecasts influence cost savings and customer bill impacts."¹²⁶

HELCO's 2021 Adequacy of Supply Report, dated January 31, 2022, shows the estimated Energy Reserve Margin will be 42% in 2023, 44% in 2024, 44% in 2025, and 46% in 2026,¹²⁷ while "[t]he Energy Reserve Margin target for [HELCO] is 30%...."¹²⁸ Thus the Energy Reserve Margin for 2023-2026 representing the Base Case, far exceeds its Energy Reserve Margin target by 14-16%. Despite this excess of energy in the Base Case, the Alternate Case did not remove any resources while adding Hu Honua, making the Alternate Case even more over-resourced. An

28, 2021; Letter of J. Ignacio to Commission, filed May 24, 2017, Attachment 2 to Exhibit A; Hawaiian Electric Companies' PSIPs Update Report, filed December 23, 2016 in Docket 2014-0183, Book 3 of 4, at J-15; and Hawaiian Electric Companies' PSIPs Update Report, filed April 1, 2016 in Docket 2014-0183, Book 1 of 2, at J-14 and Hawaii Electric Light Power Supply Improvement Plan, filed August 26, 2014 in Docket 2014-0183 at 272.

¹²³ Test. of Mr. Uyeunten, ROH, Hrg. Day 2, Mar. 2, 2022, at 00:34:00-00:34:10 ("No. No. No, we did not [conduct sensitivity analyses when running HELCO's production simulation model to determine how the bill impact results would change assuming different oil price projections and forecasts]."); Test. of Mr. Gruenemeyer, ROH, Hrg. Day 4, Mar. 4, 2022, at 00:36:39-00:36:45 ("I did not [perform a high and a low fuel price sensitivity analysis for the CA for the Hu Honua project].").

¹²⁴ See Test. of Dr. Plasch, ROH, Hrg. Day 3, Mar. 3, 2022, at 01:37:31-01:38:54 ("[T]here's a major change in energy policy between the last administration to the current.... That's clearly affected [oil] prices. What's happening in Europe, it's [also] affecting prices. ... [I]t would make a lot of sense to rerun the simulation using updated price projections, and run a number of scenarios on different prices and to try and determine whether the magnitude of consumer savings ... are negative under various scenarios.").

¹²⁵ If the PUC were inclined to request an updated bill impact analysis given the significant increase in the price of oil so that it could be better informed of the potential bill impacts, Hu Honua submits that it should at a minimum assume the following: (1) the latest 2022 Facts Global Energy (FGE) Long-Term Fuel Forecast (instead of March 2021); (2) an Alternate Case resource plan with Hu Honua added in 2022 targeted to meet the 30% Energy Reserve Margin and the RPS; and (3) Wailuku River Hydro, Tawhiri, and HEP are removed from service at the end of their PPAs (2023, 2027, and 2030, respectively. Attached hereto as **Exhibit E** are the proposed assumption changes for an updated bill impact analysis.

¹²⁶ HELCO T-3, filed Sept. 16, 2021, at 4 (emphasis added); see also Test. of Mr. Gruenemeyer, ROH, Hrg. Day 4, Mar. 4, 2022, at 00:39:23-00:40:47 ("I'm sure [the more recent fuel price forecast] would have some impact.").

¹²⁷ HELCO 2021 Adequacy of Supply Report, dated Jan. 31, 2022, at 12, Table 5: Estimated Energy Reserve Margin Percentage, <https://puc.hawaii.gov/wp-content/uploads/2022/02/Adequacy-of-Supply-HELCO-2022.pdf>.

¹²⁸ *Id.* § 2.1. at 3.

important contributor to Hu Honua appearing to increase customer bills is HELCO's failure to remove a proportionate amount of capacity from its plan when adding Hu Honua. A resource plan that intentionally exceeds its capacity will fictitiously show higher costs to customers. HELCO admits its bill impact analyses are highly dependent on long-term planning assumptions used, and the planning environment is increasingly uncertain.¹²⁹ Moreover, HELCO's assertion that the Alternate Case Plan is the same as the Base Case Plan, except for the addition of Hu Honua,¹³⁰ is contradicted by its past assertion in this docket.¹³¹ HELCO failed to develop an optimized Alternate Case with Hu Honua added in 2022 with optimized resources based on HELCO's 30% ERM criterion, RPS requirement, and lower NPM Revenue Requirement. HELCO's June 30, 2017 Bill Impact Analysis showed a \$2.50 savings over the 30-year life of the project.¹³² With an optimized Alternate Case, the savings would likely been even greater.

3. Even if the Commission Finds that the Costs Associated with the A&R PPA are Higher than Market Pricing, HRS § 269-27.3 Allows for Preferential Rates for Renewable Energy in Conjunction with Agricultural Activity.

For the reasons discussed in the SOP attached hereto as **Exhibit B**, at 39-41, even if the Commission finds the pricing of the A&R PPA may result in higher than comparative current market pricing or otherwise does not meet the "normal" PPA standard, Hu Honua's pricing could and should nevertheless be approved as a "preferential rate" pursuant to HRS § 269-27.3, consistent with the legislative goal of encouraging energy projects that have a nexus with agricultural activity. Hu Honua's production of renewable energy will rely on locally planted and harvested biomass.¹³³ Hu Honua has met the requirements for preferential rates¹³⁴ and the CA, as well as other Parties and Participants, did not dispute the validity of Hu Honua request for preferential rates.¹³⁵

¹²⁹ HELCO T-3, filed Sept. 16, 2021, at 2-3.

¹³⁰ HELCO Response to HHB-HELCO-IR-7.c.3., filed Oct. 21, 2021, at 4 ("Project benefits analysis typically only adds the subject Project to a Base case, one whose resource plan meets long range planning requirements. So if the Alternate case contemplates elimination of "other resources," the Base case would need to do so as well, while still meeting long range planning requirements."). This contradicts the statement HELCO made in its June 20, 2017 letter.

¹³¹ Ltr from HELCO to PUC, filed June 20, 2017, at 2 ("[I]n a typical resource-out/resource-in analysis of the type described herein, the addition of a firm capacity resource in the alternate, or resource-in, case would result in the displacement or deferral of future firm capacity resources.").

¹³² HELCO Letter to Commission, filed June 30, 2017, at 2.

¹³³ See Hu Honua's Response to CA/Hu Honua-IR-72, filed Feb. 18, 2020, at 3 ("Hu Honua intends to source its feedstock locally on Hawaii island.").

¹³⁴ See A&R PPA, filed May 9, 2017, Exhibit B; see also SOP attached hereto as **Exhibit B**, at 39-41.

¹³⁵ Test. of Mr. Nishina, ROH, Hrg. Day 3, Mar. 3, 2022, at 02:05:23-02:05:29 ("[M]y testimony is not disputing that [Hu Honua's request for preferential rates] was a valid request.").

4. The Commission's and Other Parties/Participants' concerns relating to Issue No. 3 have been addressed.

At the Hearing, the Commission and other Parties/Participants expressed concerns regarding the Project's pricing. Hu Honua has attempted to identify and address many of the concerns raised during the Hearing in the table attached hereto as **Exhibit D**.

C. The A&R PPA Should be Approved as it is Prudent and in the Public Interest in Light of the A&R PPA's Hidden and Long-Term Consequences (Benefits).

Statement of Issues No. 4, provides:

4. Whether the terms of the Amended PPA are prudent and in the public interest, in light of the Amended PPA's hidden and long-term consequences.¹³⁶

For the reasons discussed herein and in the SOP attached hereto as **Exhibit B**, at 42-44, the terms of the A&R PPA are "prudent and in the public interest in light of the A&R PPA's hidden and long-term consequences" as contemplated in HELCO I and HELCO II.

D. Additional Benefits of the Project.

For the reasons discussed in the SOP attached hereto as **Exhibit B**, at 44-52, the Project provides a host of additional non-GHG emissions related benefits, including the facilitation of green hydrogen efforts, the utilization of invasive species¹³⁷ that would otherwise be decomposing in landfills, the diversification of renewable energy generation on HELCO's grid, and the stimulation of the local economy with the creation agricultural and forestry sector jobs.

E. Hu Honua's Conditions of Approval.

As established in its testimonies, Hu Honua has committed and agreed to, as conditions of approval of the A&R PPA, the Project being (1) at least 30,000 MT carbon negative cumulatively over the 30-year term of the A&R PPA (no matter the level of actual dispatch), and (2) carbon negative by the year 2035 and each year thereafter until the end of the A&R PPA term.¹³⁸ In the event the annual GHG inventory shows that Hu Honua was not carbon negative for a given year from 2035 or cumulatively over the 30-year term, Hu Honua has financially committed to either (1) purchase sufficient carbon offsets to make the GHG inventory carbon negative, or (2) pay a monetary amount for the purpose of procuring sufficient carbon offsets to achieve a carbon

¹³⁶ Order No. 37910, issued Aug. 11, 2021, at 32-33.

¹³⁷ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:58:47-8:00:09 (the Project is capable of utilizing many different undesirable invasive tree species.).

¹³⁸ Hu-Honua T-1, filed Sept. 16, 2021, at 7, 27, and 29-31.

negative inventory.¹³⁹

To ensure that these two conditions of approval are realized, Hu Honua clarifies its commitments and agrees to supplementary conditions of approval to enable the Commission to hold Hu Honua accountable and enforce its carbon negative commitments. These proposed conditions,¹⁴⁰ as mentioned at the Hearing and clarified during closing argument¹⁴¹ and this Brief, are as follows:

- Hu Honua agrees to place \$100,000 (or in the alternative, a range of up to \$450,000 if the Commission believes a higher amount is more appropriate)¹⁴² of “seed money”, which may include marketable liquid assets, into a reserve fund or escrow account in Year 1 which will remain in the account for the entire 30 year A&R PPA term (or in the alternative, a lesser term if the Commission believes a lesser period of time is more appropriate) to serve as cushion of available funds to ensure that its carbon negative commitments are met. If there is any carbon sequestration deficit in the annual reporting to the PUC, Hu Honua will also place additional funds into the account each year over the 30-year term to cover the deficit and purchase carbon offsets (approximately \$15/ton);¹⁴³
- Hu Honua agrees to a condition requiring Hu Honua to provide a minimum of 3 prospective names of independent verifiers to the PUC, allow all parties to comment, then the PUC can approve which prospective names are qualified to perform the independent five-year verification, then Hu Honua will select the independent verifier from the PUC approved list;¹⁴⁴
- Hu Honua agrees to a condition that within 60 months after a final, non-appealable approval order from the PUC, Hu Honua will provide documentation¹⁴⁵ to the PUC demonstrating that

¹³⁹ Hu Honua T-1, filed Sept. 16, 2021, at 32-33.

¹⁴⁰ Assumes non-appealable PUC approval and the Project is placed into service (commercial operations).

¹⁴¹ Hu Honua Closing Argument, ROH, Hrg. Day 5, Mar. 7, 2022, at 1:43:11-1:44:17.

¹⁴² See Test. of Mr. Miyata, ROH, Hrg. Day 3, Mar. 3, 2022, at 00:38:08-00:38:24 (“Okay. There was no thought about trying to cover [in the reserve fund] the whole amount [30,000 MT carbon negative commitment] from the outset?”); *id.*, at 00:36:33-00:36:53 (“You were ... using \$15 [per] ton as a benchmark for the carbon reduction offset, is that correct?”); *id.*, at 00:36:53-00:36:56 (“Currently, that’s correct.”).

¹⁴³ See Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 07:31:57-07:33:40; 08:06:00-08:08:47; 08:17:45-08:18:26 (Mr. Lee testified to Hu Honua’s willingness to include a reserve account to ensure that there are sufficient funds to purchase carbon offsets); See Test. of Mr. Miyata, ROH, Hrg. Day 3, Mar. 3, 2022, at 00:26:08-00:28:24; 00:36:33-00:36:55 (Mr. Miyata testified to the potential amount that the reserve fund would include, including \$100,000 in “seed money”. In response to Chair Griffin’s question about the amount in “seed money” considered for the reserve fund “at the moment”, Mr. Miyata confirmed that the \$100,000 amount was “currently” the amount being considered.) This supp. condition clarifies Hu Honua’s commitment regarding the potential amount of the reserve fund.

¹⁴⁴ See Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:35:00-7:36:04 (Mr. Lee testified to the proposed process that Hu Honua is willing to follow to identify the independent third-party verifiers that would be submitted to the Commission.) This supp. condition clarifies Hu Honua’s commitment regarding the selection of independent verifiers; see also Test. of Dr. Weaver, ROH, Hrg. Day 2, Mar. 2, 2022, at 4:46:00-4:46:57.

¹⁴⁵ Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022 at 6:32:20-6:34:48 (As an example, Mr. Lee testified to Hu Honua’s discussions with a large landowner for 5,500 acres of commercial eucalyptus that may be added to Hu Honua’s current inventory.) The letter from Kamehameha Schools (“KS”), dated February 3, 2022, attached hereto as **Exhibit F**, shows that Hu Honua’s supplier has engaged in good faith discussions with KS for a license covering approximately 5,500 net acres of harvestable land with standing eucalyptus trees to be used by Hu Honua, evidencing

it has secured additional acreage on Hawaii Island to provide the feedstock for the remaining term of the A&R PPA;¹⁴⁶

- Hu Honua agrees not to receive a preferential rate for any period of energy generation using out-of-state feedstock; rather, Hu Honua would only be able to recover the Avoided Cost Rate as published monthly by HELCO for such period assuming such rate is lower than the A&R PPA rate;¹⁴⁷
- Hu Honua agrees to the recommended conditions within Hu Honua's control described in Section II.F of the CA's Prehearing Statement of Position;¹⁴⁸ and
- Hu Honua stipulates to ongoing review by the PUC for purposes of reviewing and enforcing Hu Honua's carbon negative commitments and any other commitments proffered by Hu Honua in this proceeding. If Hu Honua fails to meet any commitments, it agrees to cure any shortcomings within a reasonable time period to ensure that Hu Honua's commitments are met.¹⁴⁹

In addition, Hu Honua agrees to adopt any reasonable modifications and/or additional conditions ordered by the Commission that will enable the Commission to hold Hu Honua accountable and enforce any commitments and conditions of approval. Hu Honua would like to ensure that the benefits of the Project and its carbon negative commitments will be realized.

Hu Honua's ability to secure additional acreage for the duration of the A&R PPA under this supp. condition.

¹⁴⁶ See Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:26:25-7:27:24; Test. of Mr. Miyata, ROH, Hrg. Day 3, Mar. 3, 2022, at 00:16:40-00:17:06; 00:03:45-00:04:21 (Mr. Lee and Mr. Miyata testified to Hu Honua's preference to secure leases for the entire duration of the A&R PPA in the event Hu Honua obtained a final, non-appealable A&R PPA and confidence in extending its current leases and obtaining additional agreements for feedstock in the event Hu Honua obtained a final, non-appealable A&R PPA). This supp. condition clarifies Hu Honua's commitment regarding obtaining feedstock for the remaining term of the A&R PPA.

¹⁴⁷ In CA/Hu Honua-SIR-48.a, filed Nov. 18, 2021, the CA asked Hu Honua its position on a possible condition that the Commission should only approve preferential rates if, *inter alia*: "there is any percentage of feedstock that is sourced from outside of Hawaii, a pro rata portion of the payment at preferential rates shall be returned to customers." Hu Honua responded, in relevant part, that said condition "would be unfair to pay Hu Honua nothing, not even the market rate [(Avoided Cost Rate)], for energy generated from feedstock sourced outside of Hawaii." In its closing argument and in this supp. condition, Hu Honua clarifies it agrees not to receive a preferential rate for any period of energy generation using out-of-state feedstock; rather, it would only be able to recover the Avoided Cost Rate (or market rate).

¹⁴⁸ The CA's Prehearing Statement of Position, Section II.F, lists recommended conditions it suggested could be implemented in the event the A&R PPA is approved. See CA's Errata to Its Statement of Position, filed Jan. 3, 2022, at pg. 45-46. Hu Honua agrees to these recommended conditions, except for one which is within HELCO's control. See Test. of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:20:29-7:20:37 (In response to Mr. Kaetsu's questioning, Mr. Lee stated that "[a]s long as the condition is reasonable, [Hu Honua] certainly would want to look at that.") In this sense, Mr. Lee testified to Hu Honua's willingness to incorporate additional conditions in this proceeding. In its closing argument and in this supp. condition, Hu Honua clarifies its commitment to adopt the CA's recommended conditions.

¹⁴⁹ Mr. Lee testified that Hu Honua would stipulate to ongoing review by the Commission for purposes of review and/or enforcing the carbon negative commitments. See Test. Of Mr. Lee, ROH, Hrg. Day 2, Mar. 2, 2022, at 7:50:28-7:51:06 ("[w]e would stipulate to [ongoing review by the Commission]"). This supp. condition clarifies Hu Honua's commitment to stipulate to ongoing review by the PUC for purposes of reviewing and enforcing Hu Honua's carbon negative commitments and any other commitments.

The Commission has the authority to review and enforce conditions of approval agreed to by Hu Honua, for example, using any combination of the below methods which the Commission has used in prior decisions:

1. The Commission can require HELCO to file annual reports containing information demonstrating Hu Honua is meeting the proposed conditions.¹⁵⁰ Hu Honua will work with HELCO to develop the annual reports, and Hu Honua will file on its own or provide to HELCO for the filing of any relevant, non-confidential, information necessary for the development of the annual reports; or
2. The Commission can require HELCO to file comprehensive plans demonstrating how Hu Honua will satisfy the proposed conditions.¹⁵¹ Hu Honua will work with HELCO to develop the comprehensive plans, and Hu Honua will provide to HELCO any relevant, non-confidential, information reasonably necessary for the development of the comprehensive plans; or
3. The Commission can require HELCO and Hu Honua to amend the A&R PPA to include Hu Honua's agreement to the conditions of approval and HELCO's ability to enforce the same, and file a final Proposed Amended PPA to the Commission for approval.¹⁵²

IV. CONCLUSION.

For the foregoing reasons, Hu Honua respectfully submits that the burden for approval has been met, and approval of the A&R PPA is appropriate.

DATED: Honolulu, Hawaii, March 29, 2022.



DEAN T. YAMAMOTO

WIL K. YAMAMOTO

JESSE J. T. SMITH

YAMAMOTO CALIBOSO

A Limited Liability Law Company

Counsel for HU HONUA BIOENERGY, LLC

¹⁵⁰ See, e.g., Docket No. 2011-0060, Decision and Order, issued June 15, 2011, at 26 (“MECO shall file a quarterly progress report with the commission....”). The Commission required MECO to file the quarterly progress report containing, *inter alia*: (1) progress and approval dates permits outlined in the Application; (2) acceptable Post-Project site restoration requirements; and (3) progress of project completion; and MECO would need to collaborate with the developer to document or complete those requirements.

¹⁵¹ See, e.g., Docket No. 2020-0137, Decision and Order No. 37516, issued Dec. 30, 2020, at 40 (“[T]he Commission finds it reasonable and in the public interest to require Waiawa Phase 2 Solar to develop a comprehensive end of life management plan for project equipment during the 20-year contract term when the industry for recycling and other end-of-life programs has matured. More specifically, the end-of-life management plan should indicate whether batteries and PV panels will be repurposed, recycled, incinerated, or landfilled, the company that will be providing the service, and the cost of the service. Hawaiian Electric shall file the end-of-life management plan in this docket within five years of the date of this Order.”) (emphases added).

¹⁵² See, e.g., Docket No. 2013-0202, Decision and Order No. 31993, issued Mar. 17, 2014, at 17-18 (“Upon execution, KIUC shall file with the commission, ... the final Proposed Amended PPA.”) (emphases added)

JENNIFER JOHNSON AND FAMILY

March 28, 2022

VIA E-FILE (as Exhibit A to Hu Honua Post-Hearing Brief, filed March 29, 2022)

The Honorable Public Utilities Commission
of the State of Hawaii
Kekuana'o Building, First Floor
465 South King Street
Honolulu, Hawai'i 96813

Re: Docket No. 2017-0122

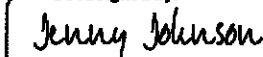
Dear Commissioners:

On behalf of the Johnson family, I want to express my deep gratitude for the opportunity Hu Honua has been given to present at this Evidentiary Hearing. The family has been involved in this project for nearly a decade because we believe in the importance of the State's RPS goal of 100% renewable energy by 2045 and want to be a partner in that. We know we are not perfect, but where we fall short we are committed to improving and doing better.

We have learned a tremendous amount over our time with Hu Honua and believe that the project we are presenting to you today is very different from what was originally proposed. We've adjusted and modified what the plant will be doing (and the conditions under which it will be operating) because we've listened and learned from community feedback, concerns and priorities. Hu Honua strongly believes that the result is a stronger, better and more inclusive PPA that addresses those items. We humbly ask the Commission to consider what we are putting forward knowing that our goal is to be a responsive and committed long-term partner.

Sincerely,

DocuSigned by:



8F8A8AE09C324CA
Jennifer Johnson and Family
Investors/Owners, Hu Honua Bioenergy, LLC

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAII

In the Matter of the Application of)
HAWAII ELECTRIC LIGHT COMPANY, INC.) DOCKET NO. 2017-0122
For Approval of a Power Purchase Agreement)
for Renewable Dispatchable Firm Energy and)
Capacity)

HU HONUA BIOENERGY, LLC'S PREHEARING STATEMENT OF POSITION

EXHIBITS "1" – "4"

AND

CERTIFICATE OF SERVICE

DEAN T. YAMAMOTO
WIL K. YAMAMOTO
JESSE J. T. SMITH
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BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAII

In the Matter of the Application of)	
)	
HAWAII ELECTRIC LIGHT COMPANY, INC.)	DOCKET NO. 2017-0122
)	
For Approval of a Power Purchase Agreement)	
for Renewable Dispatchable Firm Energy and)	
Capacity)	
<hr/>		

HU HONUA BIOENERGY, LLC'S PREHEARING STATEMENT OF POSITION

Hu Honua Bioenergy, LLC, a Delaware limited liability company ("Hu Honua"), by and through its undersigned counsel, Yamamoto Caliboso, LLLC, hereby submits its Prehearing Statement of Position ("SOP")¹ pursuant to Order No. 37852 Reopening Docket, issued June 30, 2021 ("Order Reopening Docket"), as amended, by the Public Utilities Commission of the State of Hawaii (the "Commission" or "PUC").

I. INTRODUCTION.

The Amended and Restated Power Purchase Agreement ("A&R PPA" or "Amended PPA") between Hu Honua and HELCO, dated May 5, 2017,² the approval of which is the subject of this proceeding on its second remand from the Hawaii Supreme Court ("Supreme Court") (in which the Supreme Court held that the PUC erred when it

¹ Hu Honua's SOP is timely filed pursuant to Order No. 38104, filed Dec. 7, 2021 at 7, which establishes the Amended Deadline of December 21, 2021 for Prehearing Statements of Position.

² The A&R PPA was filed in Docket No. 2017-0122 on May 9, 2017 and was approved by the Commission on July 28, 2017 on the basis that "[t]he purchased power costs and arrangements set forth in the A&R PPA appear reasonable, prudent, in the public interest, and consistent with HRS chapter 269 in general" In addition, the Commission stated that while it "finds the pricing to be reasonable, the commission makes clear that its decision to approve the A&R PPA is not based solely on pricing, but includes other factors such as the State's need to limit its dependence on fossil fuels and mitigate against volatility in oil pricing." See Decision and Order No. 34726, Issued July 28, 2017, at 60. Life of the Land ("LOL") subsequently appealed the 2017 D&O to the Hawaii Supreme Court on the basis that the PUC failed to explicitly consider greenhouse gas ("GHG") emissions in determining whether to approve the Amended PPA, as required by state law Hawaii Revised Statutes ("HRS") § 269-6(b).

failed to expressly consider the need to reduce GHG emissions in its decision-making pursuant to HRS § 269-6(b)),³ should be approved upon the PUC's consideration of the need to reduce GHG emissions. The record and evidence in this proceeding not only demonstrates that GHG emissions will be significantly *reduced*, but Hu Honua has volunteered to go beyond just reducing GHG emissions by committing, as a condition of approval of A&R PPA and backed by a financial commitment, to be carbon negative – making Hu Honua the first renewable energy project in the State of Hawaii to affirmatively commit to being carbon negative and incorporate tree planting and growing (carbon sequestration) as part of its operations.

Hu Honua is a state-of-the-art bioenergy facility (the "Project" or "Facility")⁴ that will:

- provide renewable firm dispatchable energy;
- diversify renewable energy on Hawaii Electric Light Company, Inc.'s ("HELCO") grid and support Hawaii's clean energy goals;
- significantly reduce GHG emissions and be the first energy project in Hawaii to voluntarily commit to be carbon negative as a condition of approval;
- stabilize and reduce the cost of energy as compared to fossil generation;
- enable excess renewable energy to be used towards the creation of green hydrogen and in support of the County of Hawaii's hydrogen efforts;
- enable the use of woody invasive species as an additional fuel source in collaboration with State agencies, the County of Hawaii, and HELCO to remove such undesirable and harmful growth, instead of directing such invasive species into landfills where they will simply emit carbon as they decompose;
- revitalize East Hawaii Island's agricultural and forestry sector; and

³ Matter of Hawai'i Elec. Light Co., Inc. ("HELCO II"), 149 Hawai'i 239, 487 P.3d 708 (2021).

⁴ Hu Honua was constructed with multiple emissions control equipment to include a mechanical dust collector, electrostatic precipitator, selective catalytic reduction, and a bag house to enable the collection of carbon ash to be recycled, thus implementing equipment designed to further reduce emissions.

- bring many new jobs to Hawaii Island and infuse millions of dollars into the local economy.

Hu Honua will make use of commercial crops (eucalyptus) that have sat idle and underutilized for many years or decades. The Project, which a recent public survey found that approximately 73% of Hawaii Island residents have a favorable opinion of, is more than 99% completed, will be the first utility-scale renewable energy biomass project on Hawaii Island, and will help facilitate the further integration of intermittent forms of renewable energy such as solar and wind without sacrificing grid stability and energy supply to ratepayers.

Importantly, given the recent withdrawals, uncertainties, and delays surrounding the viability of solar energy projects selected as part of HELCO's RFP 1 and 2 competitive bid solicitations that the Commission had been relying upon to support the State's renewable energy goals, Hu Honua will provide critical diversification of true-firm renewable energy on HELCO's grid, including essential grid services that cannot be provided by other types of variable or semi-firm renewable energy projects that are currently provided by true-firm fossil fuel generation.

A. Background.

On December 20, 2013, the Commission conducted a detailed review of the Project's benefits, and approved Hu Honua's original Power Purchase Agreement for 21.5 MW ("Original PPA") with HELCO at a levelized rate of approximately 25.3 cents/kwh over a 20-year term.⁵ The Commission concluded that the levelized rate should not be the sole factor and that other factors can be used to determine that a particular rate is just and reasonable, noting that "the Project will provide performance and operational features

⁵ Docket No. 2012-0212, Decision and Order No. 31758, issued Dec. 20, 2013, at 45 - 52.

similar to HELCO's existing [fossil] steam generators with dispatchable capacity, inertial and primary frequency response, regulation and load following capabilities, and will add to the diversity of HELCO's existing portfolio of renewable energy resources."⁶ In addition, "the terms and conditions of the [Original] PPA are consistent with the State's overall energy policy of reducing the State's dependence on fossil fuel," contribute to the RPS mandate, and "provide community benefits including economic stimulation and the creation of jobs ... such as forestry, harvesting, and hauling."⁷ The Commission also observed that "HELCO has made the following representations: (1) the Hu Honua plant will provide capabilities that are similar to fossil fuel steam units and that will provide dispatchable firm capacity based on energy pricing; (2) the energy from the Facility will generally displace fossil generation; and (3) the addition of the Facility may allow for certain fossil fuel generation to be decommitted."⁸ Following the Commission's approval, Hu Honua expended approximately \$175 million in reliance on the 2013 Original PPA approval, which was never appealed.

In 2016, HELCO purported to terminate the 2013 Original PPA which Hu Honua challenged, and HELCO ultimately agreed to rescind the termination and enter into the A&R PPA,⁹ dated May 5, 2017.¹⁰

On May 9, 2017, HELCO filed the A&R PPA. In Order No. 34726 ("2017 D&O"), the Commission *approved* the A&R PPA, finding, in relevant part:

[T]he commission finds that the Project will provide performance and

⁶ Docket No. 2012-0212, Decision and Order No. 31758, issued Dec. 20, 2013, at 47-48.

⁷ Docket No. 2012-0212, Decision and Order No. 31758, issued Dec. 20, 2013, at 50-51.

⁸ Docket No. 2012-0212, Decision and Order No. 31758, issued Dec. 20, 2013, at 106-107.

⁹ HELCO Testimony T-1 at 5-7.

¹⁰ Application, filed May 9, 2017. The A&R PPA amended the Original PPA in two primary ways: (a) it provides an extension of two contract milestones to allow Hu Honua to complete the biomass facility and (b) it reduces the contract's pricing and restructures the contract term. The A&R PPA also made other relatively minor and conforming amendments.

operational features similar to HELCO's existing steam generators with dispatchable capacity, inertial and primary frequency response, regulation and load following capabilities, and will add to the diversity of HELCO's existing portfolio of renewable energy resources. Stated succinctly, the Project will provide firm, dispatchable, renewable energy, and will provide ancillary services. ...

As a firm, dispatchable biomass resource, the Project provides diversification of HELCO's generation portfolio in two ways: (1) the Project's fuel source is different than any other energy resource and is less vulnerable to weather- and climate-related reliability concerns, and (2) the Project adds another form of firm, dispatchable renewable energy with operational characteristics similar to HELCO'S existing fossil-fueled steam generators. ...¹¹

In addition, the Commission held that while it "finds the pricing to be reasonable, the commission makes clear that its decision to approve the A&R PPA is not based solely on pricing, but includes other factors such as the State's need to limit its dependence on fossil fuels and mitigate against volatility in oil pricing."¹²

In approving the A&R PPA, the Commission directed Hu Honua to work expeditiously to complete the Project by the Commercial Operations Date, ordering "Hu Honua and HELCO to make all reasonable attempts to complete the Project according to this schedule," without "future requests to extend the Commercial Operations Date deadline."¹³ Hu Honua did just that and expended an additional \$315 million during the pendency of LOL's appeal (discussed below), and additional sums as of 2021 bringing the total Project costs to \$519 million.¹⁴ Yet, the pricing terms under the 2017 A&R PPA, previously approved by the PUC as reasonable, remain the same.¹⁵

The Commission's reasoning in approving the A&R PPA remains particularly

¹¹ Decision and Order No. 34726, filed July 28, 2017 ("2017 D&O"), at 53-61 (formatting modified).

¹² 2017 D&O, filed July 28, 2017, at 60.

¹³ 2017 D&O, filed July 28, 2017, at 61.

¹⁴ Hu Honua Testimony T-1, filed Sept. 16, 2021, at 6 ("At present, incurred Project development and construction costs and accrued interest total approximately \$519,461,000.").

¹⁵ See id.

prescient today given the lack of diversification of HELCO's grid, which still significantly relies on fossil fuel generated power, and given the recent withdrawals, uncertainties, and delays facing solar energy projects selected as part of HELCO's RFP 1 and 2 competitive bid solicitations.

Notwithstanding all of the important reasons that the Commission articulated for approving the 2013 Original PPA and 2017 A&R PPA, including notably reducing the State's reliance on fossil fuels and diversification of HELCO's grid, LOL appealed the 2017 D&O to the Hawaii Supreme Court on the basis that "the PUC failed to explicitly consider greenhouse gas (GHG) emissions in determining whether to approve the Amended PPA, as required by state law [HRS § 269-6(b)]."¹⁶

B. Hawaii Supreme Court Scope of Remand, Legislature Act 82, and PUC Statement of Issues.

On May 10, 2019, the Supreme Court issued HELCO I holding, among other things, that "the PUC erred by failing to explicitly consider the reduction of GHG emissions in approving the Amended PPA" pursuant to HRS § 269-6(b) and that "the PUC denied LOL due process with respect to the opportunity to be heard regarding the impacts that the Amended PPA would have on LOL's right to a clean and healthful environment," as defined by HRS Chapter 269.¹⁷ The Court remanded the proceeding and ordered the PUC to "give explicit consideration to the reduction of GHG emissions in determining whether to approve the [A&R] PPA, and make the findings necessary for this court to determine whether the [PUC] satisfied its obligations under HRS § 269-6(b)."¹⁸ The Commission failed to follow that instruction and Hu Honua appealed.

¹⁶ Matter of Hawai'i Elec. Light Co., Inc. ("HELCO I"), 145 Hawai'i 1, at 2, 445 P.3d 673, at 674 (2019).

¹⁷ HELCO I, 145 Hawai'i at 2-3, 445 P.3d at 674-675 (2019).

¹⁸ HELCO I, 145 Hawai'i at 25, 445 P.3d at 697 (emphasis in original; bracketing added).

On May 24, 2021, following the Hawaii Supreme Court's first remand of this matter in HELCO I, the Court re-affirmed and reiterated its instructions in HELCO II¹⁹ that "[o]n remand, the PUC shall give explicit consideration to the reduction of [greenhouse gas] emissions in determining whether to approve the A&R PPA, and make the findings necessary for this court to determine whether the PUC satisfied its obligations under HRS § 269-6(b)."²⁰ HELCO II also confirmed that "the court [in HELCO I] explicitly delimited the purpose of the remand" and that "[t]hese remand instructions circumscribed the scope of the attendant vacatur."²¹

On June 24, 2021, after the Court issued its opinion in HELCO II, HRS § 269-6(b) was amended by Act 82, as follows:

(b) The public utilities commission shall consider the need to reduce the State's reliance on fossil fuels through energy efficiency and increased renewable energy generation in exercising its authority and duties under this chapter. In making determinations of the reasonableness of the costs ~~[of]~~ pertaining to electric or gas utility system capital improvements and operations, the commission shall explicitly consider, quantitatively or qualitatively, the effect of the State's reliance on fossil fuels on ~~[price]~~ :

- (1) Price volatility ~~[, export]~~ ;
- (2) Export of funds for fuel imports ~~[, fuel]~~ ;
- (3) Fuel supply reliability risk ~~[, and greenhouse]~~ ; and
- (4) Greenhouse gas emissions.

The commission may determine that short-term costs or direct costs of renewable energy generation that are higher than alternatives relying more heavily on fossil fuels are reasonable, considering the impacts resulting from the use of fossil fuels. The public utilities commission shall determine whether such analysis is necessary for proceedings involving water, wastewater, or telecommunications providers on an individual basis.²²

¹⁹ HELCO II, 149 Hawai'i 239, 487 P.3d 708 (2021).

²⁰ HELCO II, 149 Hawai'i at 240, 487 P.3d 7 at 709 (internal quotation marks omitted) (quoting HELCO I, 145 Hawai'i at 25, 445 P.3d at 697) (emphases added).

²¹ HELCO II, 149 Hawai'i at 240, 487 P.3d 7 at 709.

²² Haw. Rev. Stat. § 269-6(b) (effective June 24, 2021); see also Gov. Msg. No. 1184 (June 24, 2021)

Thus, Act 82 clarified that HRS § 269-6(b) obligates the PUC, in making determinations of the reasonableness of the costs pertaining to electric utility system capital improvements and operations, such as Hu Honua's renewable energy project, to consider the effect of the State's reliance on *fossil fuels* on: (1) price volatility; (2) export of funds for fuel imports; (3) fuel supply reliability risk; and (4) greenhouse gas emissions. Importantly, Act 82 also clarified that the Commission may determine that the costs of *renewable energy generation* that are higher than alternatives relying more heavily on *fossil fuels* are reasonable, considering the *impacts resulting from the use of fossil fuels*. Thus, the legislature clarified that the PUC's obligation under HRS § 269-6(b) is to consider the *reasonableness of the cost of renewable energy generation*, such as the Hu Honua project, *against fossil fuel generation* (not against other renewable generation) given the impacts (i.e., price volatility, export of funds, fuel supply reliability risk, and GHG emissions) resulting from the use of fossil fuels.

On June 30, 2021, the Commission reopened Docket No. 2017-0122, establishing the original statement of issues. In the Order Reopening Docket, the Commission noted that "in considering the Amended PPA, [the PUC] remains obligated to follow the instructions [the Supreme Court] provided in HELCO I,"²³ which directed in relevant part, that

On remand, the PUC shall give explicit consideration to the reduction of GHG emissions in determining whether to approve the Amended PPA, and make the findings necessary for this court to determine whether the PUC satisfied its obligations under HRS § 269-6(b)."²⁴

available at https://www.capitol.hawaii.gov/session2021/bills/GM1184_.pdf (attaching Act 82).

²³ See Order Reopening Docket, issued June 30, 2021, at 8 (citing HELCO II at 8).

²⁴ See Order Reopening Docket, issued June 30, 2021, at 10 n. 22 (citing HELCO I, 145 Hawaii at 25, 445 P.3d at 697); see also HELCO II, 149 Hawaii at 7 (quoting the same).

The Commission also highlighted the following holding from HELCO I and HELCO II:

In order to comply with statutory and constitutional requirements, the PUC's post-remand hearing must afford LOL an opportunity to meaningfully address the impacts of approving the Amended PPA on LOL's members' right to a clean and healthful environment, as defined by HRS Chapter 269. The hearing must also include express consideration of GHG emissions that would result from approving the Amended PPA, whether the cost of energy under the Amended PPA is reasonable in light of the potential for GHG emissions, and whether the terms of the Amended PPA are prudent and in the public interest, in light of its potential hidden and long-term consequences.²⁵

The Commission further highlighted that "in establishing the [original] statement of issues on remand, the Commission has focused on the consideration of GHG emissions as they relate to the A&R PPA and the Project, as this was the focus of the Court's holding in HELCO I."²⁶

After Parties²⁷ and Participants²⁸ filed various motions stemming from the Order Reopening Docket, several of which attempted to expand the statement of issues beyond

²⁵ HELCO I, 145 Hawai'i at 26, 445 P.3d at 698 (emphasis added) (citing In re MECO, 141 Hawai'i 249, 269, 408 P.3d 1, 21 (2017)); see also HELCO II, 149 Hawai'i at 9 (citing the same from HELCO I).

²⁶ See Order Reopening Docket, issued June 30, 2021, at 9-10 (citing HELCO II, at 6-7).

²⁷ The Parties to this docket are HELCO, Hu Honua (collectively, "Applicants"), and the Department of Commerce and Consumer Affairs, Division of Consumer Advocacy (the "CA").

²⁸ The Participants in this docket are Life of the Land ("LOL"), Tawhiti Power, LLC ("Tawhiti"), and Hamakua Energy, LLC ("Hamakua"). See Order No. 34554, "Opening a Docket to Review and Adjudicate Hawaii Electric Light Company, Inc.'s Letter Request for Approval of Amended and Restated Power Purchase Agreement, Filed in Docket No. 2012-0212 on May 9, 2017," filed May 17, 2017.

GHG emissions,²⁹ on August 11, 2021, the Commission issued Order No. 37910³⁰ adjudicating these motions and modified the statement of issues. The Statement of Issues, as modified by Order No. 37910 ("Statement of Issues"), provides as follows:

1. What are the long-term environmental and public health costs of reliance on energy produced at the proposed facility?
 - a. What is the potential for increased air pollution due to the lifecycle GHG emissions of directly attributed the Project, as well as from earlier stages in the production process?
2. What are the GHG emissions that would result from approving the Amended PPA?
3. Whether the total costs of energy under the Amended PPA, including but not limited to the energy and capacity costs is are reasonable in light of the potential for GHG emissions.
4. Whether the terms of the Amended PPA are prudent and in the public interest, in light of the Amended PPA's hidden and long-term consequences.³¹

²⁹ On July 12, 2021, LOL and Tawhiri filed separate a Motion for Reconsideration to expand the original statement of issues established in the Order Reopening Docket. On July 20, 2021, Hu Honua filed a Motion for the Commission to Consider Act 82, arguing that the Act 82 amendments to HRS § 269-6(b) requires explicit consideration of GHG emissions within the context of "the State's reliance on fossil fuels" only, and that the Commission already approved the reasonableness of the underlying A&R PPA cost in the 2017 D&O, which was never an issue on appeal to the Supreme Court, and now the only cost component that must be considered is the GHG emissions from the use of fossil fuels – for example, consideration of GHG emissions from the use of fossil fuels in harvesting machinery, transport trucks carrying logs to the facility, and other vehicles running on fossil fuels, as well as avoided GHG emissions from existing fossil fuel plants reducing the use of fossil fuel when Hu Honua comes online. In addition, Hu Honua argued that if GHG emissions will be *reduced* as a result of the Hu Honua project, then there will be no added cost to the A&R PPA as a result of GHG emissions and no valid basis to disturb the Commission's prior approval of the A&R PPA in 2017. On August 11, 2021, the Commission denied Hu Honua's Motion to Consider Act 82. On July 23, 2021, the CA filed a Motion for Leave to Respond to LOL and Tawhiri's Motions for Reconsideration and attached a proposed response, which suggested the expansion of Issue No. 3. to include "total costs" including but not limited to "energy and capacity costs".

³⁰ Order No. 37910 (1) Denying Life of the Land's Motion for Reconsideration/Clarification of Order No. 37852 Filed July 12, 2021; (2) Denying Tawhiri Power LLC's Motion for Reconsideration of Order No. 37852, Filed on June 30, 2021, Filed July 12, 2021; (3) Denying Hu Honua Bioenergy, LLC's Motion for the Commission to Consider Act 82 and Address Its Impact on Order No. 37852 Reopening Docket Filed July 20, 2021, (4) Partially Granting the Division of Consumer Advocacy's Motion for Leave to Respond Filed July 23, 2021; and (5) Dismissing All Other Related Procedural Motions, issued Aug. 11, 2021 ("Order No. 37910").

³¹ Order No. 37910, issued Aug. 11, 2021, at 32-33.

On August 23, 2021, Hu Honua filed a Motion for Reconsideration of Order No. 37910 on the basis that the modifications to Statement of Issue No. 3 unlawfully and erroneously broadened the scope of remand against the explicit directives of the Supreme Court in HELCO I and HELCO II by adding the consideration of “total costs”, including “energy and capacity costs”, to the consideration of costs associated with “the potential for GHG emissions” given that “energy and capacity” costs under the A&R PPA was never raised on appeal, never considered by the Supreme Court, and never part of the Court’s remand instructions to the Commission. Hu Honua clarified that the only “costs” considered by the Supreme Court and remanded for the Commission to consider are the costs associated with GHG emissions pursuant to HRS § 269-6(b).³²

On August 27, 2021, the Commission denied Hu Honua’s Motion for Reconsideration regarding Statement of Issue No. 3, holding that the Supreme Court considered the costs of the Amended PPA “as a whole”, without specific emphasis on any particular component, such as the energy charge, and that HRS § 269-6(b) requires the Commission to explicitly consider the potential GHG emissions impacts related to the Project when reviewing the Amended PPA “as a whole”, including the Amended PPA’s “total costs”.

While Hu Honua respectfully maintains its objection to the modified Statement of Issue No. 3, particularly as it relates to the consideration of “total costs”, including “energy and capacity costs”, where such non-GHG related costs were never at issue in HELCO I or HELCO II, Hu Honua believes the record in this proceeding nevertheless supports the reasonableness of A&R PPA’s “total costs” including “energy and capacity costs”, within

³² Hu Honua Motion for Reconsideration, filed Aug. 23, 2021.

the context of HRS § 269-6(b), as amended by Act 82.

II. DISCUSSION.

A. The A&R PPA on Remand Should be Approved as GHG Emissions will be Reduced Over Its 30-Year Term.

1. Statement of Issues Nos. 1., 1.a., and 2.

Statement of Issues Nos. 1., 1.a., and 2., as modified, provides:

1. What are the long-term environmental and public health costs of reliance on energy produced at the proposed facility?
 - a. What is the potential for increased air pollution due to the lifecycle GHG emissions of directly attributed the Project, ~~as well as from earlier stages in the production process?~~
2. What are the GHG emissions that would result from approving the Amended PPA?³³

The record in this proceeding shows that the Project will significantly reduce GHG emissions over the 30-year term of the A&R PPA and, therefore, addresses the questions presented in Issue Nos. 1, 1.a., and 2 in a manner that supports approval of the A&R PPA.

Ramboll US Consulting, Inc. ("Ramboll"), on behalf of HELCO, prepared a GHG analyses (updated November 2021) designed to provide information the Commission needs to give express consideration to GHG emissions in its decision-making, consistent with HRS § 269-6(b) and to respond to Issue Nos. 1., 1.a., and 2.³⁴ Ramboll estimated the *Avoided Lifecycle GHG emissions*³⁵ in the amount of 1,434,243 MT CO₂e by quantifying the projected GHG emissions that would result from the operation of HELCO

³³ Order No. 37910, issued Aug. 11, 2021, at 32-33.

³⁴ HELCO response to PUC-HELCO-IR-17.b, Attachment 3 Ramboll GHG Analysis Report, filed Nov. 29, 2021.

³⁵ According to Ramboll, "[a]voided GHG emissions represents emissions that would be avoided and would not be emitted to the atmosphere if the Project is approved and built."

system facilities with and without the Project.³⁶

Hu Honua's consultant, Environmental Resources Management ("ERM"), estimated the total *Project Lifecycle GHG emissions*³⁷ in the amount of -30,499 MT CO₂e, which explicitly accounts for biogenic emissions associated with biofuel supply and combustion, and did not consider biomass as carbon neutral by default.³⁸ In typical GHG inventories, biogenic Carbon Dioxide is considered carbon neutral. However, Hu Honua has gone above and beyond just treating biomass as carbon neutral by default by performing detailed analyses and calculations to determine the GHG emissions from the Project's activities and use of biomass.³⁹ In order to measure and ensure that more biomass will be grown than is used, both the consumption and growth of biomass will be tracked. In response to HHB-CA-IR-63.a, the CA acknowledged that "[w]hile projects that have emissions, such as fossil and biomass fueled projects, may conceivably be carbon neutral through carbon accounting processes, the processes must be reviewed to verify the carbon impacts".⁴⁰ Hu Honua has created a carbon accounting process and a framework for reviewing and verifying GHG emissions accounting as further described in

³⁶ HELCO response to PUC-HELCO-IR-17.b, Attachment 3 Ramboll GHG Analysis Report, filed November 29, 2021, at 1-61. Given that this Avoided Lifecycle GHG emissions analysis is for HELCO's production simulation dispatch (e.g., at approximately 11.8 MW), the avoided emissions for a higher dispatch would be even greater.

³⁷ Accounting for all lifecycle stages such as raw materials and extraction, transportation, construction, operations & maintenance, and decommissioning & disposal, as well as boiler combustion emissions, carbon sequestration, harvesting equipment, site preparation, electricity use, transportation, fuel production, and production of fertilizer. With respect to GHG emissions in connection with decommissioning of the Project, ERM's GHG analysis provided overestimates of such emissions. Hu Honua plans to develop a decommissioning plan within 5 years of the end of the A&R PPA term.

³⁸ HELCO response to PUC-HELCO-IR-17.b, Attachment 3 Ramboll GHG Analysis Report, filed November 29, 2021, at 1-61, including ERM GHG Analysis and Table 13 attached thereto; see also Hu Honua Testimony T-4 and T-5 for further discussion regarding ERM's GHG analysis and methodology, and HU HONUA-401 and HU HONUA-402, filed September 16, 2021. Hu Honua also retained JBP, LLC ("JBP") to perform an analysis of the GHG emissions in connection with the construction of the Hu Honua facility. Discussion and/or conclusions from JBP's Construction Life Cycle Assessment, filed as Hu Honua Testimony T-6 and HU HONUA-601, are incorporated into ERM's GHG analyses for the Project.

³⁹ ERM Project GHG Analysis, at 33-63.

⁴⁰ CA Response to HHB-CA-SIR-20, filed Nov. 18, 2021, at 42-43.

ERM's GHG analysis. This approach is consistent with and supported by Cowie, et al. (2021) stating that "forest bioenergy ... biogenic carbon flows and life cycle GHG emissions should be considered".⁴¹

Combining the Avoided Lifecycle GHG emissions with the total Project Lifecycle GHG emissions results in a Net GHG Lifecycle Emissions Reduction in the amount of 1,464,742 MT CO₂e, which represents the projected reduction in GHG emissions that will be removed from the atmosphere as a result of the Commission's approval of the A&R PPA.⁴²

Accordingly, given that there will be a reduction in Net GHG Lifecycle Emissions and significant removal of GHG emissions from the atmosphere due to the Project:

Issue No. 1., "*the long-term environmental and public health costs of reliance on energy produced at the proposed facility*" will be non-existent or reduced given that the Project will *reduce* air pollution due to the reduced lifecycle GHG emissions of the Project. In fact, long-term environmental and public health should be improved by the reduction of GHG emissions.

Issue No. 1.a., "*the potential for increased air pollution due to the lifecycle GHG emissions of the Project*" will also be reduced given that the Project will *reduce* air pollution due to the lifecycle GHG emissions of the Project.

Issue No. 2., "*the GHG emissions that would result from approving the Amended PPA*" will also be reduced.

⁴¹ Cowie, AL, Berndes G, Bentsen NS, et al. Applying a science-based systems perspective to dispel misconceptions about climate effects of forest bioenergy, *GCB Bioenergy*, 2021; <https://doi.org/10.1111/gcbb.12844>, published May 7, 2021 ("2021 Cowie Study"), a copy of which is also attached as **Exhibit 1**.

⁴² HELCO response to PUC-HELCO-IR-17.b, Attachment 3 Ramboll GHG Analysis Report, filed November 29, 2021, at 1-61.

In addition, in order to ensure that the above-referenced *Project Lifecycle GHG emissions* reduction projected in ERM's analysis actually happens, Hu Honua voluntarily agrees to commit, as a condition to approval of the Amended PPA, to the Project being (1) at least 30,000 tons carbon negative cumulatively over the 30-year term of the A&R PPA (no matter the level of actual dispatch), and (2) carbon negative by the year 2035 and each year thereafter until the end of the PPA term (assuming operations allowed to begin in 2022).⁴³ Thus, the Project on its own will remove at least 30,000 tons of carbon dioxide from the atmosphere over the 30-year term of the PPA. Moreover, the Project will further reduce GHG emissions when accounting for HELCO's avoided emissions.

Hu Honua is the first utility-scale renewable energy project in the State of Hawaii that has made such a carbon negative commitment, ensuring that the Project will remove more GHG from the atmosphere than it emits, as shown in ERM's Project GHG Analysis.⁴⁴ Carbon negativity is defined as when emissions from Hu Honua's plant operations, cultivation, harvesting, and transportation are more than offset by vegetation growth.⁴⁵ Multiple studies have indicated that climate change mitigation (i.e., contributing to Carbon neutrality/Carbon Negativity) can be accomplished through the use of bioenergy,⁴⁶ like that contemplated by the Project. Here, the GHG emissions from the entire lifecycle will be sequestered. As such, the Project will be carbon negative by planting or growing more trees in native forests and/or commercial forests, as well as

⁴³ Hu Honua Testimony T-1, filed Sept. 16, 2021, at 7, 27, and 29-31.

⁴⁴ Docket No. 2017-0122, Project GHG Analysis, Attachment 3 to HELCO's Response to PUC HELCO-IR-17.b, filed Nov. 29, 2021, at 33-63; T-4, at 6.

⁴⁵ Hu Honua Testimony T-4, filed Sept. 16, 2021, at 11.

⁴⁶ 2021 Cowie Study, 13:1210-1231 ("Holistic assessments show that forests managed according to sustainable forest management principles and practices (around one billion hectares globally, of which over 420 million hectares are certified; UNECE FAO, 2019) can contribute to climate change mitigation by providing bioenergy and other forest products that replace GHG-intensive materials and fossil fuels, and by storing carbon in the forest and in long-lived forest products."), Exhibit 1.

coppicing harvested trees (including accounting for belowground biomass and soil organic carbon loss), than will be used to generate bioenergy at the facility.

To achieve these carbon negative commitments, Hu Honua will implement the planting and growing of trees on its own by Hu Honua staff or contracted vendors (to the extent permitted by landowners) or through agreements and partnerships with collaborators such as non-profit environmental organizations, including but not limited to local partners such as Friends of Hawaii Volcanoes Nation Park and One Tree Planted, or partners elsewhere such as the National Forest Foundation.⁴⁷

In addition, Hu Honua will document and verify, by issuing annual reports and independent third-party verification every 5 years, to ensure that these carbon negative commitments are met, and in the event the GHG inventory shows that Hu Honua was not carbon negative for a given calendar year beginning in 2035 or over the 30-year A&R PPA term, Hu Honua has financially committed to either (1) purchase sufficient carbon offsets to make the GHG inventory carbon negative, or (2) pay a monetary amount for the purpose of procuring sufficient carbon offsets to achieve a carbon negative GHG inventory.⁴⁸

Finally, the assumptions and methodologies that went into ERM's calculations are reasonable, defensible, and conservative (i.e., the assumptions overestimate emissions and underestimate sequestration). The methodology and framework of ERM's Project GHG Analysis is accurate, flexible, and conservative, and is valid regardless of where the biomass is sourced.⁴⁹ Because the Project's actual dispatch will likely vary and is not

⁴⁷ Hu Honua Testimony T-1, filed Sept. 16, 2021, at 31-32.

⁴⁸ Hu Honua Testimony T-1, filed Sept. 16, 2021, at 32-33.

⁴⁹ HHB's Response to CA/HU HONUA-SIR-31, filed Nov. 18, 2021, at 13.

within Hu Honua's control (HELCO controls the level of dispatch), a "Carbon Calculator" spreadsheet is included in that will calculate, track, and demonstrate Hu Honua's Carbon Negative commitment during operation.⁵⁰ This Carbon Calculator, which ERM designed to summarize varying amounts of emissions and sequestrations for the project, is set up to calculate emissions from the Facility itself, as well as other lifecycle emissions (e.g., transportation and fertilizer use), as well as carbon removed from the atmosphere through vegetation growth and offsets.⁵¹ Further, it can account for various fuel sources, such as eucalyptus or any other source.⁵²

The different sources and calculations that were used in the Carbon Calculator can be seen on the relevant tabs in the Project GHG Analysis.⁵³ Calculations of GHG emissions were performed using internationally accepted tools that are up-to-date. This includes a tool published by the Clean Development Mechanism ("CDM") Methodologies Panel of the United Nations Framework Convention on Climate Change ("UNFCCC") that was adapted for the purpose of this Project level analysis.⁵⁴ The CDM methodological tool is based on concepts and equations from the Intergovernmental Panel on Climate Change's ("IPCC") Guidelines for National Greenhouse Gas Inventories ("GNGGI") and provides a way to account for all sources of emissions related to the production of biomass on specific projects. During the Conference of the Parties (COP) 26, Article 6.4

⁵⁰ Docket No. 2017-0122, Project GHG Analysis, Attachment 3 to HELCO's Response to PUC HELCO-IR-17.b, filed Nov. 29, 2021, at 48 (containing CO2 Calculator Table).

⁵¹ Docket No. 2017-0122, Project GHG Analysis, Attachment 3 to HELCO's Response to PUC HELCO-IR-17.b, filed Nov. 29, 2021, at 36.

⁵² Docket No. 2017-0122, Project GHG Analysis, Attachment 3 to HELCO's Response to PUC HELCO-IR-17.b, filed Nov. 29, 2021, at 36 ("It can account for Hu Honua's primary fuel source – eucalyptus – as well as invasive species, if used.").

⁵³ Docket No. 2017-0122, Project GHG Analysis, Attachment 3 to HELCO's Response to PUC HELCO-IR-17.b, filed Nov. 29, 2021, at 47-63.

⁵⁴ Docket No. 2017-0122, Project GHG Analysis, Attachment 3 to HELCO's Response to PUC HELCO-IR-17.b, filed Nov. 29, 2021, at 41.

was finalized creating an international carbon trading mechanism that incorporates methodological aspects from the CDM.⁵⁵ This includes the CDM projects and methodologies that were submitted after 2013 (which includes the methodological tool used in ERM's calculations).⁵⁶ As such, even recent international agreements support the use of the methodologies used in the Project GHG Analysis.⁵⁷

The PUC and the CA, as well as other parties, have asked many detailed information requests regarding specific assumptions and methodologies such as availability and transport distances of the trees, tree growth, soil carbon, fertilizer use, and many other aspects related to the calculations. Hu Honua acknowledges that there may be other reasonable, reliable, and acceptable alternate assumptions and/or methodologies that could be used to calculate GHG emissions and sequestration. ERM has used one combination of reasonable and conservative assumptions and methodologies, and done so in a way that over-estimates GHG emissions and underestimates sequestration, thereby ensuring that the Project will be more than 30,000 tons carbon negative (even without accounting for avoided GHG emissions from displaced fossil fuel generation).

However, Hu Honua is open to working with the Commission to identify and use alternate reasonable assumptions and/or methodologies that the Commission may

⁵⁵ Simon Evans et al., COP26: Key outcomes agreed at the UN climate talks in Glasgow, CarbonBrief, <https://www.carbonbrief.org/cop26-key-outcomes-agreed-at-the-un-climate-talks-in-glasgow>, pub. Nov. 14, 2021, accessed Dec. 16, 2021 ("Article 6.4 will lead to the creation of a new international carbon market for the trade of emissions cuts, created by the public or private sector anywhere in the world.").

⁵⁶ Docket No. 2017-0122, Project GHG Analysis, Attachment 3 to HELCO's Response to PUC HELCO-IR-17.b, filed Nov. 29, 2021, at 41 ("Because the EPA has not yet settled on a final framework, and because the IPCC 2006 GNGGI is the basis used to prepare the US-EPA GHG inventory, the CDM methodological tool (based on the IPCC 2006 GNGGI protocols) was referenced and adapted for the purpose of this analysis.").

⁵⁷ Docket No. 2017-0122, Hu Honua's Response to Division of Consumer Advocacy's Third Submission of Supplemental Information Requests, filed Nov. 4, 2021, at 17-18.

prefer. Thus, if the Commission disagrees with any of Hu Honua's assumptions or would like Hu Honua to use other reasonable assumptions and/or methodologies, Hu Honua is willing to use the PUC's assumptions and/or methodologies, to the extent they are reasonable, and make the adjustments to its calculations based on such alternate reasonable assumptions and/or methodologies. Regardless of whether there are changes to the GHG emissions or sequestration calculations resulting from the use of such PUC-preferred reasonable assumptions and/or methodologies, Hu Honua's carbon negative commitments, discussed above, will remain the same. In other words, Hu Honua will adjust or increase its sequestration efforts, if needed, to account for such variation or changes to the GHG emissions or sequestration calculations based on the PUC-preferred reasonable assumptions and/or methodologies. Again, even under such alternate reasonable assumptions or methodologies, Hu Honua agrees to make its carbon negative commitments a condition of approval, and will stand by the financial consequences it has self-imposed to ensure that Hu Honua will meet its carbon negative commitments and that the Project will reduce GHG emissions.

- B. The A&R PPA on Remand Should be Approved as (1) the Cost Associated with GHG Emissions is Reasonable "in Light of the Potential for GHG Emissions"; (2) the Total Costs are Reasonable "in Light of the Potential for GHG Emissions"; and (3) Even if the Commission Finds that the Costs Associated with the A&R PPA are Higher than Market Pricing, HRS § 269-27.3 Allows for Preferential Rates.**

1. Statement of Issues No. 3.

Statement of Issues No. 3, as modified, provides:

3. Whether the total costs of energy under the Amended PPA, including but not limited to the energy and capacity costs is are reasonable in light of the potential for GHG emissions.⁵⁸

As discussed above, Hu Honua maintains its objection to Issue No. 3, as modified, on the basis that the modifications unlawfully and erroneously broaden the scope of remand against the explicit directives of the Supreme Court in HELCO I and HELCO II by adding the consideration of “total costs”, including “energy and capacity costs”, to the consideration of costs associated with “the potential for GHG emissions”. “Energy and capacity” costs under the A&R PPA were never raised on appeal, never considered by the Supreme Court, and never part of the Court’s remand instructions to the Commission. The only “cost” considered by the Supreme Court and remanded for the Commission to consider is the reasonableness of the A&R PPA cost “in light of the potential for GHG emissions” – i.e., the reasonableness of the cost associated with GHG emissions pursuant to HRS § 269-6(b).⁵⁹

Although it does not agree, Hu Honua understands that the Commission’s interpretation of HELCO I is that the Supreme Court considered the costs of the Amended PPA “as a whole,” without specific emphasis on any particular component, such as the energy charge,⁶⁰ even though the “energy charge” was never in dispute on appeal or considered by the Supreme Court. Hu Honua further understands that the Commission’s position is that HRS § 269-6(b) requires the Commission to explicitly consider the potential GHG emissions impacts related to the Project when reviewing the Amended PPA “as a whole”, including the A&R PPA’s “total costs”,⁶¹ even though the Supreme

⁵⁸ Order No. 37910, issued Aug. 11, 2021, at 32-33.

⁵⁹ Hu Honua Motion for Reconsideration, filed Aug. 23, 2021.

⁶⁰ Order No. 37936, issued Aug. 27, 2021, at 10-12.

⁶¹ Order No. 37936, issued Aug. 27, 2021, at 10-12.

Court only focused on the GHG emissions component of HRS § 269-6(b) when it determined that the PUC erred by failing to explicitly consider the reduction of GHG emissions in approving the cost of the A&R PPA.

Notwithstanding the above, Hu Honua believes that the record in this proceeding nevertheless supports the reasonableness of the cost associated with GHG emissions, as well as the A&R PPA's "total costs" including "energy and capacity costs" pricing, within the context of HRS § 269-6(b).⁶²

2. The Cost of the A&R PPA Associated with GHG Emissions is Reasonable "in Light of the Potential for GHG Emissions".

Hu Honua will reduce the cost associated with GHG emissions and help to achieve State and Federal policy goals by reducing GHG emissions from the energy sector. The Supreme Court remanded this matter for the Commission to consider GHG emissions impacts in approving the A&R PPA.⁶³

As discussed above, Hu Honua will reduce lifecycle GHG emissions. HELCO indicated lifecycle GHG emissions of -10 kg/MWh and operating emissions of -62kg/MWh).⁶⁴ In addition, Hu Honua's carbon negative commitment to sequester 30,000 metric tons more carbon than it emits makes it the only generator in HELCO's resource plan offering a negative incremental GHG impact; wind and solar, geothermal, and fossil-fuel generators all increase lifecycle GHG emissions to varying degrees.

⁶² Hu Honua Testimony T-1, filed Sept. 16, 2021, at 18-22.

⁶³ HELCO I, 145 Hawai'i 1, 28, 445 P.3d 673, 700 (2019) ("As set forth above, HRS § 269-6(b) requires the PUC to expressly consider the reduction of GHG emissions in its decision-making. The PUC failed to do so in determining whether the costs associated with the Amended PPA were reasonable, and in approving the Amended PPA.").

⁶⁴ Testimony of Abigail Kirchofer, PhD (HELCO Testimony T-5), filed Sept. 16, 2021, at 4. HELCO subsequently filed a revised analysis, after the Puako Solar contract had been withdrawn, with values of -10 and -62 kg/MWh respectively. See HELCO response to PUC-HELCO-IR-17.b filed Nov. 29, 2021, at 6.

In February 2021, the Federal government published its estimates of the cost to society of GHG emissions for each year from 2020 through 2050.⁶⁵ Hu Honua's pricing consultant, Dr. Jonathan Jacobs of PA Consulting Group, Inc. ("Dr. Jacobs") computed the dollar value of Hu Honua's emissions reduction, based on results from HELCO's emissions analysis based on HELCO's Puako-in simulation. Based on that computation, the A&R PPA would avoid \$68 million in GHG emissions related costs that would otherwise be imposed by the GHG emissions of other generators. ERM then extrapolated the GHG emissions that would be avoided if Hu Honua were operating at full Committed Capacity dispatch and Dr. Jacobs calculated the associated avoided cost in the amount of \$132 million.

At the dispatch levels in the 2021 Puako-out analysis, generation from Hu Honua would avoid \$96 million that would otherwise be imposed by the GHG emissions of other generators. The sequestration of more carbon than the Hu Honua plant itself emits would avoid an additional \$2.6 million in costs – a total benefit (cost savings) of \$96 million under the 2021 Puako-out scenario. If Hu Honua were dispatched more – as would happen even in the moderate 2020 PGV-in simulation – the value of resulting emission reductions could exceed \$132 million.⁶⁶ On a levelized basis, the emissions benefit of Hu Honua exceeds the estimated difference between the all-in costs of Hu Honua and HELCO's fossil generation, and could be much more.⁶⁷

⁶⁵ See Exhibit HU HONUA-701, filed Sept. 16, 2021, at 11 (note 13).

⁶⁶ Exhibit HU HONUA-701 filed Sept. 16, 2021, at 12, Table 3; values for the Puako-out case (including avoided HELCO emissions from the HELCO response to PUC-HELCO-IR-17.b) were substituted into the formulas for the "Low Dispatch Case" to obtain the cost values (\$96 million, etc.) for that case.

⁶⁷ This is in the Puako-out dispatch case. The Testimony of Jonathan Jacobs (Hu Honua Testimony T-7), filed Sept. 16, 2021, at 7, indicated that the emissions benefit of Hu Honua was at least half the estimated difference in all-in costs; see also Hu Honua Response to Tawhiri-Hu Honua-IR-41, filed October 21, 2021. Those figures were computed having known only the total dispatch over 30 years (2,686 GWh) and not the

By dispatching Hu Honua as part of an *economically efficient* strategy – rather than focusing solely on minimizing fuel and variable O&M costs – HELCO could even more effectively optimize GHG emissions reductions, resulting in further cost savings. For example, using the Federally-estimated GHG emissions costs, every MWh of energy displaced by Hu Honua in the Puako-out case results in levelized cost savings of \$35.50/MWh. For economically efficient dispatch, cost signals should recognize the true cost per MWh of GHG emissions, which would ultimately discourage the operation of fossil-fueled generators and encourage the use of non-GHG emitting renewables. Thus, all else equal, an economic approach to accounting for GHG impacts in dispatch would tend to increase Hu Honua's generation (and thereby reduce its all-in cost).

Given that Hu Honua will reduce GHG emissions related costs to the tune of a \$98 million to \$132 million in cost savings, the cost of the A&R PPA associated with GHG emissions is not only reasonable, but a significant benefit to ratepayers, as well as the State and Federal governments.

3. Total Costs of the A&R PPA, including Energy and Capacity Costs, Are Reasonable "in Light of the Potential for GHG Emissions".

Turning to the issue of "whether the total costs under the Amended PPA, including but not limited to the energy and capacity costs, are reasonable in light of the potential for GHG emissions," this "total cost" should still be confined within the context of HRS § 269-6(b), which obligates the PUC, in making determinations of the reasonableness of the costs pertaining to electric utility system capital improvements and operations, such as Hu Honua's A&R PPA, to consider the effect of the State's reliance on *fossil fuels* on:

annual pattern; this sentence describes a computation that has been updated to reflect the annual dispatch pattern of the Puako-out simulation (2,979 GWh over 30 years).

(1) price volatility; (2) export of funds for fuel imports; (3) fuel supply reliability risk; and (4) *greenhouse gas emissions*.

The Commission, in clarifying the scope of participation on remand in its Order Reopening Docket, stated that,

in light of the new statement of issues, which all focus on GHG emissions associated with the Project and the Commission's statutory obligations under HRS Chapter 269, the Commission believes it would be beneficial for all Parties and Participants to address all issues set forth for this proceeding on remand.⁶⁸

The Commission subsequently stated that HRS § 269-6(b) requires the Commission to explicitly consider the potential GHG emissions impacts related to the Project when reviewing the Amended PPA “as a whole”, including the A&R PPA’s “total costs”.⁶⁹

Under the clear and unambiguous language of HRS § 269-6(b) as amended,⁷⁰ the Commission is obligated to determine “quantitatively or qualitatively” the reasonableness of costs associated with the Project as compared to fossil fuels and in consideration of the effect of the State’s reliance on (1) *fossil fuels on price volatility*, (2) *export of funds for fuel imports*, (3) *fuel supply reliability risk*, and (4) *greenhouse gas emissions*. Thus, the legislature clarified that the PUC’s obligation under HRS § 269-6(b) is to consider the *reasonableness of the cost of renewable energy generation*, such as the Hu Honua project, *against fossil fuel generation* (not against other renewable generation) given the impacts (i.e., price volatility, export of funds, fuel supply reliability risk, and GHG emissions) resulting from the use of fossil fuels.

Hu Honua’s pricing consultant has considered the reasonableness of Hu Honua’s

⁶⁸ Order No. 37852 Reopening the Docket, issued June 30, 2021 at 11 (emphases added).

⁶⁹ Order No. 37936, issued Aug. 27, 2021, at 10-12.

⁷⁰ HRS § 269-6(b) (effective June 24, 2021) (emphasis added).

pricing in the context of HRS § 269-6(b) as amended⁷¹ and also notes that “[t]he commission may determine that short-term costs or direct costs of renewable energy generation that are higher than alternatives relying more heavily on fossil fuels are reasonable, considering the impacts resulting from the use of fossil fuels.”⁷²

- a. The Total Costs of the A&R PPA are Reasonable Considering the Effect of the State’s Reliance on Fossil Fuels on (1) Price Volatility, (2) Export of Funds for Fuel Imports, (3) Fuel Supply Reliability Risk, and (4) GHG Emissions.

In considering the reasonableness of the “total costs” of the A&R PPA, HRS § 269-6(b) requires the Commission to explicitly consider, quantitatively or qualitatively, the effect of the State’s reliance on fossil fuels on:

- (1) Price volatility;
- (2) Export of funds for fuel imports;
- (3) Fuel supply reliability risk; and
- (4) Greenhouse gas emissions.

HRS § 269-6(b) also allows the Commission to determine that short-term costs or direct costs of renewable energy generation that are higher than alternatives relying more heavily on fossil fuels are reasonable, considering the impacts resulting from the use of fossil fuels.⁷³

With respect to price volatility, Hu Honua provides valuable insurance against fossil fuel oil price variability and inaccurate price forecasts. Hu Honua’s cost is prescribed in the A&R PPA and, therefore, it will not swing with fossil fuel prices. As a

⁷¹ Hu Honua T-7, filed Sept. 16, 2021, at 3-4; Exhibit HU HONUA-701, filed Sept. 16, 2021.

⁷² HRS § 269-6(b) (emphasis added).

⁷³ Haw. Rev. Stat. § 269-6(b) (effective June 24, 2021); see also Gov. Msg. No. 1184 (June 24, 2021) available at https://www.capitol.hawaii.gov/session2021/bills/GM1184_.pdf (attaching Act 82).

result, Hu Honua will reduce the price volatility of energy costs. Oil prices by nature can be very uncertain or volatile, and such inherent volatility and variability of oil prices creates risk for consumers. The cost of a renewable resource with predictable pricing – even if higher than the current cost of a fossil fueled resource – may be reasonable to avoid the danger of volatile pricing spikes.

With respect to the export of funds for fuel imports, Hu Honua again provides valuable insurance against having to export funds to pay for fossil fuel imports. As Hu Honua stated several times throughout this proceeding, Hu Honua desires and intends to source all of its biomass locally in Hawaii as its primary feedstock will consist of locally available eucalyptus.⁷⁴ Sourcing feedstock locally will also keep costs down and will support keeping jobs on Hawaii Island.⁷⁵ As a result, Hu Honua will reduce the export of funds for fuel imports.

With respect to the fuel supply reliability risk, Hu Honua again provides valuable insurance against fossil fuel supply reliability risk. Similar to fossil fuel generation, Hu Honua will provide true-firm dispatchable energy available 24/7 year-round, except because the biomass fuel source is abundant and locally available, the risk of biomass fuel supply is lower than that of fossil fuel that must be imported by ship into Hawaii and is subject to global shortages. As a result, Hu Honua will reduce fuel supply reliability risk. An added benefit of having a locally available fuel supply that can generate true-firm 24/7 renewable energy is that it also reduces reliability risk as compared to variable renewable resources such as intermittent (weather-dependent) solar or wind for

⁷⁴ See Hu Honua Response to LOL-IR-2021-10, LOL-IR-2021-48(b), filed Oct. 21, 2021, at 70; Hu Honua Testimony T-1, filed Sept. 16, 2021, at 15-17; Hu Honua Testimony T-2, filed Sept. 16, 2021, at 4; and Hu Honua Response to PUC-Hu Honua-IR-28(d), filed Oct. 29, 2021, at 33.

⁷⁵ Hu Honua Testimony T-2, filed Sept. 16, 2021, at 4.

fuel, including solar paired with semi-firm storage⁷⁶.

With respect to the GHG emissions, as discussed above, Hu Honua will reduce GHG emissions by avoiding fossil fuel GHG emissions as well as reducing GHG emissions as part of its operations. Moreover, Hu Honua has made a carbon negative commitment to ensure that GHG emissions will not only be reduced, but also negative. As a result, Hu Honua will reduce GHG emissions.

b. The Total Costs of the A&R PPA are Reasonable “As a Whole”.

As discussed above, although it does not agree, Hu Honua understands that the Commission’s position is that HRS § 269-6(b) requires the Commission to explicitly consider the potential GHG emissions impacts related to the Project when reviewing the Amended PPA “as a whole”, including the A&R PPA’s “total costs”.⁷⁷ As also discussed above, HRS § 269-6(b) as amended⁷⁸ requires the Commission to determine “quantitatively or qualitatively” the reasonableness of costs associated with the Project as compared to fossil fuels, and even allows the PUC to determine that short-term costs or direct costs of renewable energy generation that are higher than alternatives relying more heavily on fossil fuels are reasonable, considering the impacts resulting from the use of fossil fuels.”⁷⁹

In light of this, Hu Honua asked Dr. Jacobs to evaluate the reasonableness of Hu Honua’s pricing as compared to fossil fuel generation. As indicated in PA Consulting’s

⁷⁶ “Semi-firm storage” means storage that is firm only during the limited periods when it has sufficient charge to be dispatched to the grid. For example, a 4-hour battery is firm for a mere 4 hours if it (1) has been fully charged by PV panels; and (2) cannot continue to be charged due to darkness in the evening or lack of sunshine during cloudy days.

⁷⁷ Order No. 37936, issued Aug. 27, 2021, at 10-12.

⁷⁸ HRS § 269-6(b) (effective June 24, 2021) (emphasis added).

⁷⁹ HRS § 269-6(b) (emphasis added).

Updated Report of the Pricing of the A&R PPA, dated December 20, 2021, attached hereto as Exhibit 2,⁸⁰ if Hu Honua is fully utilized to displace fossil fuel generation, its “all in” levelized cost is less than that of fossil generation. A levelized “all in” cost averages capital and other fixed costs over the amount of energy generated.⁸¹ If HELCO were to dispatch Hu Honua at its full Committed Capacity, Hu Honua’s levelized all in cost would be \$41.41/MWh or 4.141 cents/KWh *less* than a representative fossil fuel unit (i.e., the Keahole combined cycle unit).⁸² In fact, the levelized all in cost of representative fossil fueled generation over a 30-year operating period would be 80 percent *higher* than that of Hu Honua.⁸³ Using HELCO’s sales forecast, the estimated bill savings under a full Committed Capacity dispatch is \$3.64/month.⁸⁴ What is important about these estimates is that they are savings to ratepayers, not added costs. Furthermore, they are levelized bill impacts (average present values). As a result, the “total costs” under the A&R PPA are reasonable “as a whole”.

Hu Honua can cost-effectively displace fossil-fueled generation, resulting in an

⁸⁰ The Report (Exhibit HU HONUA-701) has been updated to account for HELCO’s testimony, including HELCO’s sales forecast among other things, and to include discussion of the “Puako-out” simulation described by HELCO in its response to a PUC Information Request. The updated report also corrects inadvertent computational errors that had been noted in Hu Honua’s responses to PUC-Hu Honua-IR-41 and Tawhiri-Hu Honua-IR-39, and updates the values in Table 3 from draft values that did not match Table 1. Finally, quotations from a draft version of Exhibit HU HONUA-401 were updated to the final version, and missing or incorrect footnotes have been corrected.

⁸¹ Levelized all in cost is more commonly referred to as Levelized Cost of Energy (LCOE) but in this docket Hu Honua has used the term “levelized all in cost” and we will continue to do so.

⁸² Exhibit HU HONUA-701 filed Sept. 16, 2021, at 10 (Table 2).

⁸³ Exhibit HU HONUA-701 filed Sept. 16, 2021, at 7 (Figure 1).

⁸⁴ In Hu Honua Testimony T-1, which referenced HU HONUA-701, these monthly average savings were reported as “over \$6.60”. See Hu Honua Testimony T-1, at 20, filed Sept. 16, 2021, quoting Exhibit HU HONUA-701, at 3 and 10. In a more recent filing, Hu Honua called attention to a computational error and the initial estimate not including revenue tax, and suggested that a better estimate of the average monthly savings was \$3.78. See Hu Honua Response to PUC-Hu Honua-IR-41(b), filed Oct. 29, 2021, at 78. The original \$6.60 estimate was made before HELCO had filed its sales forecast. See Exhibit HELCO-305, filed Sept. 16, 2021, at 1, column d; identical sales forecast provided in response to PUC-HELCO-IR-17. Using HELCO’s sales forecast, the estimated bill savings under a full Committed Capacity dispatch is \$3.64/month.

average savings to ratepayers. As a result, HELCO should dispatch Hu Honua to displace fossil generation to the greatest extent possible because it is operationally less costly.

The average cost of energy from Hu Honua, including all variable charges (fuel payment and variable O&M payment) is less than the average cost of energy from HELCO's fossil plants. This is illustrated in PA Consulting's Updated Report of the Pricing of the A&R PPA, Exhibit 2, which relies on calculations based on the Keahole combined cycle plant as a reasonable proxy for HELCO's entire oil-fired fleet,⁸⁵ showing that the average cost of energy from Hu Honua would be less than the average cost of fossil-fueled energy in every year of the A&R PPA term. To obtain a single number that accurately values energy output, project generation costs should be compared on a levelized unit (per MWh) basis. The projected levelized energy cost of Hu Honua is 14.212 cents/kWh, less than 60% of the 25.996 cents/kWh cost of fossil-fueled energy.⁸⁶

- c. "Bill impacts" in HELCO's analyses are increased by the low dispatch of the plant, compared with other analyses.

Since the Order Reopening Docket,⁸⁷ HELCO has filed three separate bill impact analyses in 2021. These analyses should be considered in comparison with two prior analyses filed in the docket in 2017 and 2020.

- (a) The bill impact analysis filed prior to the Commission's approval of the A&R PPA in 2017 ("2017 HEP-in") indicated that the "NPV" bill impact of the A&R PPA would be a net increase of \$2.43. This analysis included the

⁸⁵ Hu Honua Testimony T-7 and Exhibit HU HONUA-701. The Hill 5 & 6 and Puna Steam plants, which have high heat rates (but use less expensive fuel) are removed early in HELCO's project horizon. See Exhibit HELCO-301, filed Sept. 16, 2021. Based on PA's review of ECRC filings, the Keahole plant is less expensive to operate than Hamakua Energy, which is only contracted through 2030.

⁸⁶ Exhibit HU HONUA-701, filed Sept. 16, 2021, at 7 (Figure 1).

⁸⁷ Order No. 37852, issued June 30, 2021.

assumption that the Hamakua Energy contract would be renewed upon its expiration in 2030. Under Commission direction, HELCO revised its assumption that the contract was not renewed ("2017 HEP-out") and arrived at a net savings of \$1.21.⁸⁸

- (b) The testimony HELCO filed in 2020 included two separate "bill impact" analyses. One was based on the assumption that the Puna Geothermal Venture (PGV) would not return to service after having been rendered inoperable by lava ("2020 PGV-out"), one on the assumption that it would return ("2020 PGV-in"). The 2020 PGV-In case indicated that the levelized bill impact of the A&R PPA would be a net increase of \$10.97.⁸⁹
- (c) After the docket was reopened in 2021, HELCO filed prehearing testimony including a "bill impact" analysis that indicated that the average bill impact of the A&R PPA would be \$13.69 (2021 Puako-in).⁹⁰
- (d) The 2021 Puako-in analysis included the assumption that the Hamakua Energy contract would be renewed upon its expiration in 2030, as well as several other future projects between 2022-2051, which are highly speculative. This Hamakua extension, as well as other future projects between 2022-2051, have not been approved by the Commission. In Docket No. 2016-0333, the Commission issued Decision and Order No. 34356, stating:

At this time, the future use and value of the HEP Facility after 2030 is uncertain and any valuation assumptions

⁸⁸ Letter from D. Brown to: Commission Re: Project Economic and Bill Impact Analysis, filed July 7, 2017, Exhibit A, at 5 and 6.

⁸⁹ Exhibit HELCO-305, filed Jan. 28, 2020, at 2.

⁹⁰ Testimony of Robert Y. Uyeunten (HELCO Testimony T-3), filed September 16, 2021, at 7.

beyond the PPA's scheduled termination are speculative without supporting analyses or documentation.

....
[G]iven that the HEP Facility is not expected to be a major energy provider by 2030, Applicants' assumption that the HEP Facility will still be operating at 65% capacity is an unsupported and overly-optimistic assumption.⁹¹

Hu Honua asked HELCO to revise its analysis to remove unapproved projects from its resource plan — in other words, remove speculative unapproved future projects and only assume projects approved by the PUC to date. HELCO did so, and for that case HELCO filed bill impacts for every year but did not indicate the average.⁹² We have computed the average, it is an average bill savings of \$0.36.

- (e) After ENGIE 2020 ProjectCo-HI1 LLC declared its Puako Solar PPA null and void,⁹³ HELCO prepared another economic analysis ("2021 Puako-out") removing the Puako plant from its resource plan (but again including the Hamakua Energy extension and all other unapproved projects). Inasmuch as the 2021 Puako-in analysis is no longer a reasonable representation of any resource plan, we believe that the 2021 Puako-out case is now HELCO's preferred analysis. HELCO filed bill impacts for every year in the 2021 Puako-out analysis, but again not the average.⁹⁴ We have

⁹¹ Docket No. 2016-0333, Decision and Order No. 34356, issued May 4, 2017, at 63-65; Letter from Daniel G. Brown to PUC regarding Project Economic and Bill Impact Analysis, filed June 30, 2017, at 1 ("In order to assess the Hu Honua Project's amended pricing, the Company's supplemental work utilized a production simulation model and performed a resource-in, resource-out analysis. The analysis sets up a baseline the Companies' 'E3' resource plan developed for Hawai'i Island in their *PSIP Update Report: December 2016*, with the modification that HEP is removed from the model after 2030.").

⁹² HELCO's response to CA/HELCO-IR-63, filed Oct. 21, 2021, Attachment 4, at 1.

⁹³ Docket No. 2020-0189, Letter from K. Katsura to: Commission Re: Withdrawal of Request for Approval of PPA, filed Nov. 2, 2021.

⁹⁴ HELCO's response to PUC-HELCO-IR-17, filed Nov. 22, 2021, HELCO-305 Attachment 2, at 1.

computed the average bill impact in the Puako-out case and it is \$10.97.

HELCO stated in its Prehearing Testimony that “the various project benefits analyses have been directionally consistent under constantly changing assumptions that indicated customer bills may increase with the addition of the Project.”⁹⁵ It is true that the bill impacts in HELCO’s preferred analyses have consistently increased over time. There are two intertwined drivers of these increases: since 2017 the dispatch of Hu Honua in HELCO’s simulations has been lowered and HELCO’s oil price forecasts have consistently declined.

In the “Puako-out” analysis, Hu Honua’s simulated generation is only 2,979 GWh⁹⁶ over its 30-year contract (an average power output of 11.8 MW, which is not far above its minimum generation level of 10 MW).⁹⁷ This very low projected output for Hu Honua suggests a statistically biased forecast⁹⁸ and represents a significant departure from the “2020 PGV-in” simulation HELCO provided in its 2020 testimony.⁹⁹

A levelized all-in cost analysis demonstrates that the more a generator is dispatched for energy, the less its fixed costs will affect its average overall cost. This can be seen from some of the alternative analyses that HELCO has produced. Various alternatives described above, by eliminating some other resources, included more generation from Hu Honua and concomitantly lower bill impacts.

⁹⁵ Testimony of Robert Y. Uyeunten (HELCO Testimony T-3), filed Sept. 16, 2021, at 8.

⁹⁶ HELCO response to PUC HELCO IR 17 filed November 22, 2021, Attachment 1, at 1 (Table 1).

⁹⁷ We believe the Puako-out analysis is now HELCO’s preferred scenario because the Puako contract has been voided; however, HELCO’s September testimony included a simulation with Hu Honua dispatching 2,686 GWh over its 30-year contract (an average of only 10.7 MW), which appears to have influenced the parties’ expectations. See Exhibit Hu Honua-501 filed September 16, 2021, at 30; also Exhibit Hu Honua-201 filed September 16, 2021, at 1-2 (Table 1).

⁹⁸ See Hu Honua’s Response to Tawhiri-Hu Honua-IR-43, filed Oct. 21, 2021, at 15.

⁹⁹ Exhibit HELCO-201, Testimony of Robert Y. Uyeunten (HELCO Testimony T-3) and Exhibits HELCO-301 through HELCO-305, filed Jan. 28, 2020.

- In 2017, the change from a “2017 HEP-in” to a “2017 HEP-out” analysis (removing the unapproved Hamakua Energy project) changed the bill impact from a \$2.43 *increase* to a \$1.21 *savings*.
- Removing unapproved projects from HELCO’s resource plan reduced the bill impacts by over 100%, from an increase of \$13.69 to a savings of \$0.36.
- Removing Puako Solar reduced the bill impacts from an increase of \$13.79 to an increase of \$10.97.
- With Hu Honua in place, the “RFP 3” procurement may be uneconomic and unnecessary – especially since the Puako withdrawal indicates that a contract price at that level (Puako PPA pricing) is no longer achievable.¹⁰⁰

d. HELCO’s “bill impact” analyses are not by themselves a good basis for resource decisions because over time they have increasingly favored the continued or expanded use of fossil fuels.

The baseline from which Hu Honua’s bill impacts are measured includes HELCO’s existing oil-fired plants, and the prices forecasted for that baseline have been reduced. This would tend to make the use of oil for power generation more desirable. On the other hand, HRS § 269-6(b) encourages the PUC to reduce the use of fossil fuel oil for electricity. HELCO’s “bill impact” analyses run counter to that. The historical trend of HELCO’s bill impact analyses, and the PUC reliance on the same, suggests that the PUC finds HELCO’s inputs regarding the decrease in fossil fuel pricing acceptable, as well as the continuation of HELCO forecasting a low oil price regime and the continued use of fossil fuel oil. HRS 296-6(b) requires the PUC to consider the negative impacts of fossil

¹⁰⁰ Docket 2020-0189, Letter From R. Matsushima To: Commission Re: Project Update filed October 28, 2021, Exhibit 1, at 1-2.

fuel generation in considering the reasonableness of the cost of renewables relative to fossil fuels, yet the PUC has not requested that the utility conduct such an analysis that compares the cost of renewable generation against fossil fuel generation.

- e. The structure of HELCO's "bill impact" analyses artificially inflates the projected impact of Hu Honua on customer bills.

In the three simulation runs filed in 2021, HELCO forecasted 6,570 GWh *more* in overall HELCO sales in 2021 than in its 2020 PGV-in simulation, and the increase in HELCO's energy requirement is even greater because it has to generate or purchase more energy than it sells to cover for losses. However, in the 2021 Puako-out simulation, HELCO had Hu Honua producing 850 GWh *less* than in the 2020 PGV-in simulation (3,829 GWh in 30 years, an average dispatch of 14.6 MWh per year). In the 2021 Puako-in production simulation, Hu Honua's production was even lower, 1,140 GWh less than in the 2020 PGV-in simulation. Even with an intermediate level of dispatch for Hu Honua – comparable to its dispatch in the 2020 PGV-in case – its all-in costs would be less than representative fossil-fueled costs.¹⁰¹

The comparatively low dispatch of Hu Honua in HELCO's preferred simulations is a consequence of the way HELCO structured its analysis. Each of HELCO's analyses of the "bill impacts" of the A&R PPA is based on two production simulation runs – the Base Case and the Alternate Case.¹⁰² The Base Case simulates the operation of the HELCO system for the life of the resource under consideration. Because the projection horizon can extend thirty years or more into the future, changes in HELCO's load must be

¹⁰¹ Exhibit HU HONUA-701, filed Sept. 16, 2021, at 10 (Table 1 row 3 and Table 2 row 3).

¹⁰² Testimony of Robert Y. Uyeunten (HELCO Testimony T-3) and Exhibits HELCO-301 through HELCO-305, filed September 16, 2021, at 12-13. HELCO subsequently produced two variations of the analysis: (1) removing all unapproved resources from the resource plan (HELCO's response to CA/HELCO-IR-63, filed October 21, 2021) and (2) removing only the Puako Solar contract from the resource plan after the counterparty withdrew the contract (HELCO's response to PUC-HELCO-IR-17, filed November 22, 2021).

considered as well as the end of the useful lives or contract periods of existing resources. Unless additional resources were added to the HELCO system, the system would be unreliable or fail to meet targets for energy or capacity margins. HELCO thus “builds out” a resource plan for the Base Case from a set of potential additions which it has defined; crucially, the set of potential additions will *not* contain the resource under consideration.

The Alternate Case simulates the operation of the HELCO system under the Base Case set of resources *plus* the resource under consideration and the identified resource additions from the Base Case. The “bill impact” of the resource under consideration is defined to be the difference between the simulated costs of the two runs.

Because the Alternate Case simulates the operation of the HELCO system under the Base Case set of resources *plus* the resource under consideration, it is actually over-resourced. The Base Case set of resources was already chosen to allow the system to be reliable and any additional capacity would create an uneconomic excess. Note that a resource plan that is developed to assure reliability should include capacity that would look excessive on economic considerations in an *expected* operating scenario, since it contains extra capacity to ensure against the *unexpected*.

The structure of this analysis is flawed, especially when applied to a resource with a capacity price or fixed cost. Consider the following example where HELCO is proposing a contract with resource A, which has an operating cost of \$10M and a fixed cost of \$10M:

- BASE CASE
 - To operate successfully (absent resource A), HELCO recognizes the need for resource B, which has a higher operating cost than A, \$19M, but a lower capital cost of \$5M. This results in a total cost of \$24M.
- ALTERNATE CASE

- HELCO includes resource A in its Alternate Case, but also still includes resource B. Because the operational costs of resource A are less than those of resource B, however, it appears most cost advantageous to run resource A and never run resource B. The total cost for the Alternate Case is \$25M (\$15M total capital cost of A and B and \$10M operating costs for A).

Unfortunately, neither the Base Case nor Alternate Case present the possibility of adding *only* resource A. The Alternate Case would clearly not be a prudent resource plan. Because the Alternate Case reveals a total cost of \$1M more than the Base Case, HELCO would report adding resource A was more expensive and not add it at all. To justify its methodology, HELCO states, "To have an Alternate case with fewer resources [other than resource A] than the Base case would cause changes (including any cost savings) that would be due to removal of those resources and not the addition of [resource A]."¹⁰³ This logic is incorrect, however, because adding resource A may very well eliminate the need for additional generation (i.e., resource B). The cost savings shortsightedly attributed to removing resource B are in fact due to including resource A.

Returning to the comparison of HELCO's analyses conducted in 2021 in relation to the "2020 PGV-in" analysis – rather than increasing dispatch of Hu Honua, the newer analyses require HELCO to supply additional energy – 7,824 GWh in the 2021 Puako-out case (an average of 261 GWh per year),¹⁰⁴ somewhat more in the Puako-in case -- to compensate for increased sales and resulting system losses. HELCO's resource plans include new generation resources without considering the ability of Hu Honua to provide that additional energy.

¹⁰³ HELCO's response to HHB-HELCO-IR-7, filed Oct. 21, 2021, at 4.

¹⁰⁴ 6,570 GWh of increased load, 6.2% of that (407 GWh) for associated losses, and 847 MWh to make up for the reduction in Hu Honua generation.

Having added Hu Honua to the resource plan in the Puako-out simulation, HELCO might not have had to add all the resources in its Base Case, may have been able to terminate other contracts (e.g., the contract with Hamakua Energy, a fossil fuel GHG emitter), and/or may have been able to retire (physically or financially) other resources, especially fossil fuel resources. The PUC should therefore not rely on HELCO's "bill impact" methodology, neither 2021 Puako-in nor 2021 Puako-out, because they fail to recognize the fixed expenditures that could have been cost-effectively deferred by Hu Honua.

- f. Hu Honua can provide the resiliency needed in case of multi-day adverse weather events.

The increasing penetration of intermittent renewables creates greater exposure to weather risk (e.g., storms impairing solar radiation), however, and the Kauai Island Utility Cooperative (KIUC) has advocated for the value of more-conventional generation (firm renewables) to mitigate weather uncertainty.¹⁰⁵ While power systems with limited renewable penetration may successfully utilize storage to meet peak availability, maintaining output for extended periods of time can be cost-prohibitive.

Thus, firm dispatchable renewable resources like Hu Honua can offer a viable alternative. In fact, Hu Honua has presented evidence that the levelized price for a comparably sized photovoltaic project would be up to four times as expensive as Hu Honua (assuming unit price is computed similarly to that of the RFP 1 contracts).¹⁰⁶

¹⁰⁵ Docket 2020-0218, Application of Kauai Island Utility Cooperative for Approval of Power Purchase Agreement with AES West Kauai Energy Project, filed Dec. 31, 2020, at 14.

¹⁰⁶ See Hu Honua's Response to Tawhiri-Hu Honua-IR-39, filed Oct. 21, 2021.

- g. Hu Honua supports overall system reliability and control as Hawaii transitions to a fully renewable electricity system.**

Reliability of a modern power system relies on stable frequency and voltage. Conventional generators – inertia-based large rotating masses in magnetic fields – help maintain a steady frequency. Battery storage and “smart inverters” accomplish fast frequency response, but they must be controlled algorithmically whereas a conventional generator responds automatically. The value of just some of these grid support services is estimated to be \$54,000 to \$125,000 per MW-year.¹⁰⁷

As the Consumer Advocate pointed out in a Supplemental Information Request,¹⁰⁸ the island of Kauai has been able to obtain most of its grid services from inverter-based generation during the day. But KIUC itself has stressed the importance of rotating generators, such as Hu Honua, for system security: “Rotating, synchronous generators provide increased inertia, voltage support, and fault current to the electric grid as compared to similarly-sized inverters.”¹⁰⁹ The automatic (through not automated) response of inertia-based generation like Hu Honua offers a distinct advantage and can also produce high surge current needed for fault detection or black start.

Due to its location, Hu Honua is also uniquely positioned to offer reliable voltage support. Most of the new renewables on the Big Island are located on the West side; however, the East side is likely to need further support due to its reliance on the retiring W.H. Hill and Puna units. While HELCO has not thoroughly analyzed the need and value for grid services in East Hawaii, the HELCO Grid Needs Assessment report identifies a

¹⁰⁷ Exhibit HU HONUA-701 filed Sept. 16, 2021, at 701.

¹⁰⁸ CA-Hu Honua-SIR 45, filed Nov. 4, 2021.

¹⁰⁹ Docket 2020-0218, Application of Kauai Island Utility Cooperative for Approval of Power Purchase Agreement with AES West Kauai Energy Project, filed Dec. 31, 2020, at 14.

need for additional grid resources, and furthermore suggests that much of that need could be met by Hu Honua.¹¹⁰

4. Even if the Commission Finds that the Costs Associated with the A&R PPA are Higher than Market Pricing, HRS § 269-27.3 Allows for Preferential Rates for Renewable Energy in Conjunction with Agricultural Activity.

Even if the Commission finds the pricing of the A&R PPA may result in higher than comparative current market pricing or otherwise does not meet the “normal” PPA standard, Hu Honua's pricing could and should nevertheless be approved as a “preferential rate” pursuant to HRS § 269-27.3, consistent with the legislative goal of encouraging energy projects that have a nexus with agricultural activity.

HRS § 269-27.3 provides:

(a) It is the policy of the State to promote the long-term viability of agriculture by establishing mechanisms that provide for preferential rates for the purchase of renewable energy produced in conjunction with agricultural activities. The public utilities commission shall have the authority to establish preferential rates for the purchase of renewable energy produced in conjunction with agricultural activities.

(b) Upon receipt of a bona fide request for preferential rates for the purchase of renewable energy produced in conjunction with agricultural activities, and proof that the renewable energy is produced in conjunction with agricultural activities, a public utility shall forward the request for preferential rates to the public utilities commission for approval.¹¹¹

As established by the Commission, that “[t]he term ‘preferential rates’ inherently contemplates rates that are above what would otherwise be available in the open market. The legislative history to HRS § 269-27.3 indicates that this was intended to cover a

¹¹⁰ Docket 2017-0352, Hawaiian Electric System Planning, *Hawai'i Island: Near-Term Grid Needs Assessment, Draft Report*, filed July 15, 2021, at 18.

¹¹¹ HRS § 269-27.3.

renewable energy producer's 'costs and a reasonable return on investment[.]'"¹¹²

For the purposes of HRS § 269-27.3, "renewable energy" refers to electrical energy produced or generated from renewable sources, and renewable fuels, such as biogas, biomass, and biofuel, should be considered as sources of 'renewable energy.'"¹¹³ Hu Honua will generate renewable energy using biomass and, therefore, is eligible to receive preferential rates.

Specifically, HRS § 269-27.3 allows for preferential rates for the purchase of renewable energy produced "in conjunction with agricultural activities". "Agricultural activities" is defined by HRS § 269-1 as:

a commercial agricultural, silvicultural, or aquacultural facility or pursuit conducted, in whole or in part, including the care and production of livestock and livestock products, poultry and poultry products, apiary products, and plant and animal production for nonfood uses; the planting, cultivating, harvesting, and processing of crops; and the farming or ranching of any plant or animal species in a controlled salt, brackish, or freshwater environment.¹¹⁴

Hu Honua's production of renewable energy will rely on locally planted and harvested biomass.¹¹⁵ Agriculture has historically been a significant industry for Hawaii Island providing much needed jobs for the people of East Hawaii in Hilo and up the Hamakua Coast. The agriculture industry on Hawaii Island has rapidly declined, leaving workers in the industry without the hopes of current and future employment. The Hu Honua Project will help re-establish and serve as a foundation for this industry in East

¹¹² See Docket 2015-0324, Decision and Order No. 33945, filed Sept. 26, 2016, at 27 (adopting, inter alia, the Hearing Officer's Recommended FOF and COL. ("Recommended Decision") Paragraph 1 "and the analysis related thereto" and citing Recommended Decision at pages 24-26).

¹¹³ See Docket 2015-0324, Decision and Order No. 33945, filed Sept. 26, 2016, at 28-32, 53.

¹¹⁴ HRS § 269-1 (emphasis added)

¹¹⁵ See Hu Honua's Response to CA/Hu Honua-IR-72, filed Feb. 18, 2020, at 3 ("Hu Honua intends to source its feedstock locally on Hawaii island.").

Hawaii Island for at least the thirty-year term of the A&R PPA and perhaps longer.¹¹⁶ The Project would directly create local, permanent, high-skilled, and high-paying jobs in connection with the harvesting, cultivating, and harvesting biomass for the Project.¹¹⁷ Hu Honua hopes that once it helps re-establish and solidify the workforce for agricultural industry in East Hawaii Island, it would help draw in additional projects and opportunities to take advantage of this re-vitalized industry on the island.

Because the renewable energy from the Hu Honua project is in conjunction with the agricultural activities associated with utilizing, processing, and harvesting commercially grown crops, as well as the agricultural activities associated with the planting of future crops, Hu Honua is uniquely positioned to advance “the policy of the State [in] promot[ing] the long-term viability of agriculture” and the legislature has mandated the “establish[ment] [of] mechanisms that provide for preferential rates for the purchase of renewable energy produced in conjunction with agricultural activities” as contemplated under HRS § 269-27.3.

The Commission’s consideration of and approval of preferential rates, as provided by HRS § 269-27.3, would comply with the Legislature’s mandate to the Commission to consider preferential rates for renewable energy projects that will have attendant benefits for the agricultural industry. Such benefits to the agricultural industry are discussed in further detail below with respect to the Project’s additional benefits.

¹¹⁶ See Testimony of Warren Lee, filed as HU HONUA TESTIMONY T-1, filed Sept. 16, 2021, at 11-12.

¹¹⁷ See generally Testimony of Dr. Bruce Plasch, filed as HU HONUA TESTIMONY T-8, filed Sept. 16, 2021.

C. The A&R PPA on Remand Should be Approved as the A&R PPA is Prudent and in the Public Interest in light of the A&R PPA's Hidden and Long-Term Consequences (Benefits).

1. Statement of Issues No. 4.

Statement of Issues No. 4, provides:

- 4. Whether the terms of the Amended PPA are prudent and in the public interest, in light of the Amended PPA's hidden and long-term consequences.¹¹⁸**

The terms of the Amended PPA are “prudent and in the public interest in light of the Amended PPA's hidden and long-term consequences” as contemplated in HELCO I and HELCO II. With respect to the consideration of the “Amended PPA's hidden and long-term consequences,” such consideration is confined to the GHG emissions associated with the Project – as this was the only context in which the Hawaii Supreme Court considered such issues in HELCO I.¹¹⁹ Indeed, the “hidden and long-term consequences” discussed in HELCO I and HELCO II are within the context of HELCO I's reference to In re MECO,¹²⁰ where the Supreme Court had previously ruled in the context of reviewing another PPA, that HRS § 269-6(b) required the Commission “to consider the hidden and long-term costs of energy produced under the Agreement, including the

¹¹⁸ Order No. 37910, issued Aug. 11, 2021, at 32-33.

¹¹⁹ In HELCO I, the Court found that the Commission failed to substantiate its finding that the A&R PPA was “reasonable, prudent, in the public interest, and consistent with HRS chapter 269 in general” because it failed to address “the hidden and long term environmental and public health costs of reliance on energy produced at the proposed facility as required.” HELCO I, 145 Hawaii at 24, 445 P.3d at 696 (emphasis added). The Court in HELCO I further explained that “[t]hese costs include ‘the potential for increased air pollution as a result of GHG emissions’ directly attributed to energy generation at the facility, as well as GHG emissions produced at earlier stages in the production process, such as fuel production and transportation.” HELCO I, 145 Hawaii at 24, 445 P.3d at 696 (emphasis added) (citing MECO, 141 Hawai‘i at 283, 408 P.3d at 15). See also MECO, 141 Hawaii at 265-266, 408 P.3d at 17-18 (discussing the Commission's statutory requirements under HRS § 269-6(b) to consider the “hidden and long-term costs” associated with the Pu‘unene Plant, all of which focused on consideration of GHG emissions associated with the project).

¹²⁰ In re MECO, 141 Hawaii 249, 408 P.3d 1 (2017).

potential for increased air pollution due to GHG emissions.”¹²¹

Applied to this proceeding, the Supreme Court clarified that “these costs include ‘the potential for increased air pollution as a result of GHG emissions’ directly attributable to energy generation at the facility, as well as GHG emissions produced at earlier stages in the production process, such as fuel production and transportation.”¹²² Thus, whether the A&R PPA is “prudent and in the public interest in light of the Amended PPA’s hidden and long-term consequences” applied to this remanded proceeding requires the consideration of the potential for increased air pollution as a result of GHG emissions, which is essentially the same consideration discussed above regarding Issue 1.a.

As mentioned above, given that there will be a reduction in GHG emissions, the *potential for increased air pollution due to the lifecycle GHG emissions of the Project* should also be reduced. Therefore, the A&R PPA is “prudent and in the public interest in light of the Amended PPA’s hidden and long-term consequences,” i.e., in light of the reduction of the potential for increased air pollution.

In addition, the discussion of Issue 3 included a quantification of the value of reducing GHG emissions using estimates of the costs that would have been imposed by such GHG emissions. Those costs do not typically appear in utility financial accounts and are not collected in rates; they are “hidden”. Here, the GHG emissions costs avoided by the A&R PPA are hidden costs that will be avoided as a result of the A&R PPA – thus, Hu Honua’s reduction in GHG emissions will reduce costs associated with GHG emissions and become a hidden cost benefit to ratepayers, making the A&R PPA prudent and in the public interest.

¹²¹ HELCO I, 145 Hawaii at 24, 445 P.3d at 696.

¹²² HELCO I, 145 Hawaii at 24, 445 P.3d at 696 (citing In re MECO, 141 Hawaii at 263, 408 P.3d at 15).

To the extent the Commission interprets Issue No. 4. more broadly as requiring consideration beyond “the potential for increased air pollution as a result of GHG emissions,” and applies the “prudent and in the public interest in light of the Amended PPA’s hidden and long-term consequences” issue to the A&R PPA as a whole, we would respectfully disagree and object to such broad application of this remanded issue. Nevertheless, Hu Honua believes the overall benefits offered by the A&R PPA, even under such overly broad interpretation, make it prudent and in the public interest.

As discussed in the section regarding Issue No. 3, above, there are several examples in which the A&R PPA is prudent and in the public interest.

- The levelized bill savings that could be attained from the A&R PPA at full Committed Capacity dispatch while displacing fossil fuel generation results in an estimated average bill savings of \$3.64/month, thus approval of the A&R PPA is prudent and in the public interest.
- Taking advantage of an opportunity to reduce GHG emissions and the cost associated with GHG emissions, in the amount of a \$99 million to \$132 million savings (a hidden cost benefit), is prudent and in the public interest.
- A fully renewable system will require renewable tools, such as a firm dispatchable unit like Hu Honua, for system security and control and it is prudent to begin acquiring them now.
- Increasing the use of renewable resources whose costs are independent of variable oil prices is prudent and in the public interest as it increases electricity price stability, while relying on oil price forecasts that are historically low is not prudent or in the public interest because it favors the use of fossil fuels and would tend to “lock in” oil dependence.
- Relying on an analysis method that assumes a new resource put in place in 2022 that will be accompanied by potentially surplus capacity from other resources added later is not prudent (poor planning practice).

D. Additional Benefits of the Project.

Lending further support for the approval of the A&R PPA is that the Project

provides a host of additional non-GHG emissions related benefits, including the facilitation of green hydrogen efforts, the utilization of invasive species that would otherwise be decomposing in landfills, the diversification of renewable energy generation on HELCO's grid, and the stimulation of the local economy through the creation of jobs and educational and training opportunities.

1. Utilization of Invasive Species as an Additional Fuel Source for Renewable Energy.

The Project will enable the use of invasive species on Hawaii Island as an additional fuel source for the Project to generate renewable energy, in collaboration with State agencies, such as the Hawaii Department of Transportation ("DOT"), the County of Hawaii, and HELCO, as well as private landowners.¹²³ Hu Honua can utilize up to ten percent (10%) invasive species as an additional fuel source.¹²⁴ This consideration is significant as it not only creates opportunities to divert such invasive species away from landfills where they will emit carbon as they decompose, but also allows the invasive species to be used to generate renewable energy.¹²⁵

Indeed, DOT has expressed that it is "happy to partner with [Hu Honua] to provide highways waste to the Hu Honua Bioenergy facility for fuel" as it "will be aggressively addressing the invasive trees" along the Hawaii Island roadways and powerlines "to ensure that our system is more resilient to the extreme weather events we have been experiencing more often."¹²⁶ As DOT recognizes, delivering invasive species to the

¹²³ T-1 at 8, 10-11; Response to CA/Hu Honua-IR-125(e).

¹²⁴ Docket No. 2017-0122, Hu Honua Response to Tawhiri-Hu Honua-IR-36, filed Oct. 21, 2021, at 2.

¹²⁵ T-1 at 8, 10-11; Response to CA/Hu Honua-IR-125(e); see also Docket No. 2017-0122, Edwin H. Sniffen Letter, dated November 9, 2021 ("Sniffen Letter"), Exhibit 3 to Hu Honua's Response to Division of Consumer Advocacy's Third Submission of Supplemental Information Requests, filed Nov. 4, 2021, filed Nov. 18, 2021, at 1 ("These invasive trees are normally dumped at the landfill, or at a green waste facility to decompose.").

¹²⁶ Sniffen Letter, at 1.

Facility is "expected to be cost neutral for DOT, and will make positive use of green waste to generate renewable energy instead of dumping them in landfills and increasing carbon emissions as they decompose."¹²⁷

2. Facilitation of Hawaii Island's Green Hydrogen Efforts.

A potential benefit of Hu Honua is its ability to provide excess energy from the Project (i.e., energy outside the Committed Capacity reserved for HELCO's ratepayers) for use in generating green hydrogen in collaboration with third-party hydrogen stakeholders and the County of Hawaii.¹²⁸ As reflected in the executed memorandum of understanding ("MOU") with H2 Energy, LLC, a hydrogen pilot program on Hawaii Island, Hu Honua is in discussions to develop a hydrogen infrastructure on Hawaii Island through, for example, the construction of a hydrogen fueling station that would be powered by the excess energy from the Project that is not committed to HELCO.¹²⁹ Moreover, because the portion of excess energy would not utilize utility resources nor go to or be paid by ratepayers in concept, the use of excess energy for hydrogen would not be subject to the A&R PPA review in this proceeding.¹³⁰

3. Diversification of Renewable Energy on HELCO's Grid.

The Project will also diversify renewable energy on HELCO's grid and provide essential grid services that are currently provided by existing fossil generating facilities, and that cannot be provided by intermittent solar or semi-firm limited duration batteries. While Hu Honua acknowledges the value that other sources of renewable energy may bring to HELCO's grid, diversification with the addition of a biomass Facility is important

¹²⁷ Sniffen Letter ,at 1.

¹²⁸ T-1, at 9-10; Exhibit HU HONUA-101.

¹²⁹ T-1 at 9-10; Exhibit HU HONUA-101.

¹³⁰ T-1, 10; Response CA/Hu Honua-IR-115(c), -124(c); Response to CA/Hu Honua-IR-138.

as it helps to make the grid less vulnerable to weather-related reliability (solar and wind), volcanic activity (geothermal), and price fluctuations inherent with importing and refining fossil fuel oil.¹³¹

Hu Honua is a “firm dispatchable resource” that can be controlled to operate at any desired level within its capacity and can be freely dispatched whenever needed because it has an onsite fuel supply.¹³² The Project’s additional benefit, as a firm dispatchable resource, is exemplified in the context of fuel and energy supply risk considerations. For example, the addition of a substantial amount of solar energy to an island grid introduces fuel supply reliability risk, where the “fuel” is sunshine and (1) solar power is only available during the day; (2) solar power is intermittent as the sun and clouds move across the sky; and (3) solar power is susceptible to impairment during extended periods of storm and overcast weather.¹³³ Given the unreliability of solar to provide firm dispatchable energy, and the recent uncertainty, delays, and/or withdrawals regarding the development of certain RFP 1 and 2 solar projects – as evidenced by force majeure notices issued by certain RFP 1 and 2 projects¹³⁴ and the withdrawals of the RFP 2 Puako Solar and

¹³¹ T-1, at 8-9; Hu Honua’s Response to CA/HU Honua-IR 120; Tawhiri’s Response to HHB-TP-SIR-15(a)(2) (agreeing that the “sun doesn’t always shine and the wind doesn’t always blow.”); see also Jun. 1, 2020 Letter from Hawaiian Electric to PUC Regarding Hawai’i Electric Light Company, Inc. Rebuild Agreement and PPA Negotiations with Puna Geothermal Venture Quarterly Update, <https://puc.hawaii.gov/wp-content/uploads/2020/06/HELCO.RebuildAgreementPPAwith-Puna-Geo.-VentureQuarterly.20200601.pdf>, at 5 (“In addition to rebuilding the overhead transmission line segments, the Company must also rebuild the Pohoiki Switching Station that was destroyed during the 2018 Kilauea eruptions.”) (emphasis added); id. at 2 (“PGV voluntarily installed SO₂ monitoring as a result of the post eruption residual emissions that are still active. Since the eruption there are still numerous fissures continuing to emit SO₂ and H₂S.”) (emphasis added); Final Decision and Order No. 35545, Docket No. 2016-0328, filed Jun. 22, 2018 at 63 n.162 (“The commission observes that utilization of renewable resources can result in decreased risk and volatility of fossil fuel costs, both as a result of the substantial fixed energy cost components of renewable generation resources and power purchase contracts, and due to lower resulting amounts of fossil fuel utilization.”) (emphasis added).

¹³² T-7, at 8; Exhibit HU HONUA-701, at 16.

¹³³ T-7, at 8; Exhibit HU HONUA-701, at 16.

¹³⁴ See, e.g., Docket No. 2019-0050, AES West Oahu Response to PUC-AES Solar-IR-1, filed Nov. 15, 2021, at 2, 5 (“Seller continues to take commercially reasonable efforts to remedy the impact of the Force Majeure event to the extent practicable. . . . While Seller continues to evaluate options, it is unlikely that

Waikoloa Village Solar projects.¹³⁵ In addition, given the Hawaii State Legislature's recent concerns regarding the over-reliance on solar PV and batteries, and lack of firm renewables,¹³⁶ the Project presents a ready-to-implement solution to the State's immediate desire to add firm renewable resources.

Diversification of renewable energy by the Project also aligns with the Commission's inclinations on future generation of electricity, which takes into account both customer interests and public policy goals. Indeed, the Commission has voiced that it "supports a balanced and diverse portfolio of energy resources as the best long-term strategy to achieve the state's energy goals," and that such diversity includes biomass sources.¹³⁷ Therefore, in addition to contributing to the State's goal of reaching 100%

other options will be feasible to meet the current GCOD of September 7, 2022. Accordingly, if Seller is unable to obtain reasonable comparable modules that can be delivered [redacted], the current GCOD of September 7, 2022 will be jeopardized and will likely need to be extended."); Docket No. 2018-0430, AES Waikoloa Solar Response to PUC-AES Waikoloa-IR-06, filed Nov. 15, 2021, at 4 (stating that if Seller is unable to acquire reasonable comparable modules, the current GCOD of November 3, 2022 "will be jeopardized and will likely need to be extended."); Docket No. 2021-0024, HECO November 2021 Monthly Update, filed Nov. 17, 2021, at 18 ("On Oct 18, 2021, AES [Kuihelani Solar] delivered a Notice of Force Majeure based on communications with its solar panel supplier . . ."); *id.*, at 56 ("On October 7, 2021, [Mahi Solar] submitted updated schedule with an 18-month Force Majeure delay with a Commercial Operations Date of 5/31/25."); *id.*, at 71 ("[Pulehu Solar] submitted updated schedule with an 18-month Force Majeure delay with a Commercial Operations Date of October 31, 2024."); Docket No. 2020-0136, Kapolei Energy Storage Response to PUC-KES-IR-110, filed Oct. 14, 2021, at 2 ("KES is still feeling the effects of the Force Majeure condition. Supply chains around the globe have been and still are experiencing shortages that are driving up costs and pushing out delivery timelines.").

¹³⁵ See Docket No. 2020-0189, Letter from Hawaiian Electric to PUC Regarding Withdrawal of Request for Approval of PPA for Puako Solar, filed Nov. 2, 2021.

¹³⁶ Docket No. 2021-0024, Letter from Senator Donovan M. Dela Cruz and Senator Glenn Wakai dated Oct. 18, 2021, Attachment to Letter from James P. Griffin, Chair, Hawaii Public Utilities Commission, filed Nov. 3, 2021, <https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21K04B11326F00649> at pages 6-7/10 of PDF ("Firm renewable technology would provide clean, always-on capacity needed to retire oil-fired units. . . . A firm renewable plant would not limit further deployment of intermittent renewable technologies.").

¹³⁷ Exhibit A: Commission's Inclinations on the Future of Hawaii's Electric Utilities – Aligning the Utility Business Model with Customer Interests and Public Policy Goals, <https://puc.hawaii.gov/wp-content/uploads/2014/04/Commissions-Inclinations.pdf>, Apr. 28, 2014, at 5 ("Pursue a balanced portfolio of new energy resources – There is clear evidence that pursuing a diverse portfolio of renewable energy resources provides the best long-term strategy to maximize the use of renewables to achieve public policy goals. . . . **[T]he Commission supports a balanced and diverse portfolio of energy resources as the best long-term strategy** to achieve the state's energy goals. **This principle overarches a wide spectrum of issues, such as firm versus variable resources**, types of renewable resources (e.g., wind,

RPS, the Project will provide the additional benefit of diversifying HELCO's grid while displacing existing fossil fuel plants.

4. Benefits to the Local Economy: Creation of Jobs, Commitment to Educating the Community in Connection with the Project, and Revitalization of the Agricultural Industry.

Hu Honua will serve as a cornerstone for combining renewable energy with agricultural activities on Hawaii Island, and the Project is in a unique position to step into the shoes of East Hawaii Island's former sugar industry, providing a foundational 30-year economic engine that will support multiple industries.

First the Project has created (during construction) and will create (during operations) hundreds of skilled, high paying permanent and temporary jobs, including but not limited to skilled labor at the Project site, construction jobs, forestry jobs, trucking jobs, and jobs in connection with the administration and operation of the Project.¹³⁸ For example, once fully staffed the Project will create 38 fulltime and permanent jobs in connection with the Project's operation and administration, and the composition of employees will be similar to its current staffing in which most positions are currently filled by Hawaii Island residents. Another example, as shown in Dr. Bruce Plasch's Updated Economic Impacts and Benefits Report, dated September 2021, Hu Honua-801 ("2021 Plasch Report"), is that during construction, Hu Honua created approximately 245 jobs on Hawaii Island and about 313 jobs statewide.¹³⁹ When the Project is fully operational, the Project will generate between 177 to 238 direct and indirect jobs (depending on the

solar, biomass, hydro, geothermal, and waste to energy, etc.), geographic location, and utility-scale versus distributed resources." (bold in original) (bold and underline emphases added).

¹³⁸ Hu Honua Testimony T-1, at 11.

¹³⁹ Hu Honua Testimony T-1, at 12; Exhibit HU HONUA-801.

level of dispatch) with an annual payroll between \$8,928,970 and \$11,649,915.¹⁴⁰

Second, in conjunction with Hu Honua's dedication to promoting education and training of Hawaii Island residents, the Project has provided valuable opportunities to learn about the Project and the forestry industry at large. Some examples of Hu Honua's ongoing dedication to such matters includes: (1) Hu Honua's offer to Hawaii Community College ("HCC") in Hilo to use a location of the Project's property to study forestry and the growth and harvest of trees;¹⁴¹ (2) the funding of career technical programs in agriculture and automotive repair at HCC for high school students to obtain dual high school and college credits; and (3) Hu Honua's internship opportunities in connection with the Project, which allows student interns to learn about Hu Honua's workforce and to gain valuable job experience.¹⁴²

Third, the Project will support and revitalize the local agricultural industry on Hawaii Island and make use of commercial crops that have sat idle and underutilized for several years. Hu Honua will obtain feedstock primarily from commercially grown crops that have been converted into wood chips, which will be combusted as fuel to heat the facility boiler that will, in turn, generate steam for electricity generation.¹⁴³ Moreover, the lands used by Hu Honua to acquire its feedstock sources will have the opportunity to be replant or coppice trees, thereby maintaining the land for long-term use as commercial forests and the continued sequestering of carbon in a sustainable and renewable carbon sequestration cycle.¹⁴⁴ Without the Project and need for commercial forests, these lands

¹⁴⁰ Hu Honua Testimony T-1, at 12; T-8 at 6-7; Exhibit HU HONUA-801.

¹⁴¹ Hu Honua Testimony T-1, at 12.

¹⁴² Hu Honua Testimony T-1, at 12-13.

¹⁴³ Hu Honua Testimony T-1, at 6; T-3 at 5.

¹⁴⁴ Hu Honua Testimony T-1 at 28.

may be deforested permanently, including being re-purposed for other low-sequestration agricultural activities, such as vegetable or coffee farming, or re-zoned for a housing development with concrete laid where trees once stood.¹⁴⁵

5. Community Support in Favor of the Project.

In light of the aforementioned benefits, including those related and not related to GHG emissions, it is not surprising that the Project has strong community support on both the local and statewide level. Since the Order Reopening Docket was issued in June 2021, the docket reflects that 91 individuals have filed letters of support for the Project. In contrast, only 8 individuals have filed letters indicating that they do not support the Project.¹⁴⁶

For example, the President of the Hawaii Forest Industry Association ("HFIA"), Don Bryan, has voiced support, expressing that the Project is "a critical component in both carbon sequestration and self-sufficiency on Hawaii Island" given its use of "residual" wood to create energy and cautioning the Commission that "[y]ou cannot encourage an investment to proceed at a cost of many millions, and then ultimately destroy it, and then expect meaningful future investments in job creation."¹⁴⁷ Mr. Bryan's support for the Project has been echoed by other Board Members of the HFIA Board of Directors.¹⁴⁸

¹⁴⁵ Hu Honua Testimony T-1 at 28; Hu Honua's Response to CA/Hu Honua-IR-131.

¹⁴⁶ See List of Hu Honua Bioenergy Supporters vs. Opponents, filed between July 2 to December 20, 2021, attached as Exhibit 3.

¹⁴⁷ See Public Comment of Don Bryan, filed Oct. 22, 2021.

¹⁴⁸ See, Public Comment of Peter D. Simmons, Board Member of the HFIA Board of Directors, filed Oct. 20, 2021 (calling attention to the "additionality" of carbon sequestration the Project has brought to Hawaii Island, Hu Honua's creation of "opportunities for processing higher value parts of trees that can be used locally and in the international market," and the Project's "opportunities to reclaim some of the land that is now smothered with strawberry guava"); Public Comment of Ron Wolfe, Board Member of the HFIA Board of Directors, filed Oct. 27, 2021 (affirming Peter Simmons' October 20, 2021 comments based on Mr. Simon's long-time experience in forest resource management on Hawaii Island, and highlighting the Project's benefits to diversify renewable energy as part of a "multifaceted strategy" to reduce dependence on hydrogen fuels and "achieve energy security").

Similarly, the President of Forest Solutions, Inc., Irene Sprecher, has highlighted that the Project will provide the “economic base needed to further develop the forest and agricultural industries in Hawaii,” while noting the Project’s contributions to several of Hawaii’s sustainability goals, including Hawaii’s 100% renewable energy goal by 2045, Hawaii Interagency Biosecurity Plan, development of diversified agricultural opportunities, and the State’s 100 million tree by 2030 pledge.¹⁴⁹

Lending further support for the Project, a recent public opinion survey conducted by the Anthology Marketing Group, dated December 2021, found that approximately 73% of Hawaii Island residents have a favorable opinion of the Project.¹⁵⁰ As the recent survey reflects, the Project’s broad spectrum of benefits and unique contributions to Hawaii’s carbon neutral goals has garnered widespread community support and is another reason the Commission should approve the A&R PPA.

E. Responses to CA, LOL, and Tawhiri.

1. The CA.

The CA attempts to introduce a number of issues outside of the circumscribed scope of remand, including those associated with pricing, under “total costs” considerations, and “public interest.” With respect to pricing considerations, as discussed above, such considerations are improper as they were never at issue in HELCO I and HELCO II.¹⁵¹ The Commission already determined that the energy and capacity costs under the A&R PPA are reasonable, and the reasonableness of such costs was never appealed or considered by the Supreme Court – rather, only the cost associated with

¹⁴⁹ See Public Comment of Irene Sprecher, filed Oct. 18, 2021,.

¹⁵⁰ See Anthology Hawaii Island Community Study, dated December 2021, attached as Exhibit 4.

¹⁵¹ See supra Sections II.A and II.B.4.

GHG emissions was addressed.¹⁵²

With respect to “public interest” considerations, Hu Honua cautions against the adoption of the CA’s broad and amorphous standard for considering certain issues under the guise of “public interest.” For example, in the CA’s Response to HHB-CA-SIR-26(c), which asked the CA to elaborate on potential “public health concerns,” the CA stated:

[While] [t]he hazards of the logging industry are not in question in this docket, . . . Worker health and safety is simply a single component of the project as a whole when assessing the public interest. However, some of these hazards spill over into the public sector during transport and depending on where some of the processes take place. When the hazards spill over into the public, these become externality concerns that should be included in the assessment of the public interest and weighed against the benefits of the project.¹⁵³

It appears that the CA would like to introduce new issues unrelated to GHG emissions,¹⁵⁴ such as the hazards of the logging industry when they “spill over” into the public sector. Such a broad standard improperly expands the scope of this remanded proceeding, which the Supreme Court clearly stated is to “make the findings necessary for [the Supreme Court] to determine whether the PUC satisfied its obligations under HRS § 269-6(b).”¹⁵⁵

Given HELCO II, the introduction of new issues under the guise of “public interest”

¹⁵² 2017 D&O.

¹⁵³ CA’s Response to HHB-CA-SIR-26(c), filed Nov. 18, 2021, at 59 (emphasis added).

¹⁵⁴ Other examples where the CA has admitted to raising issues not directly related to GHG emissions include the CA’s Responses to HHB-CA-SIR-8 and HHB-CA-SIR-23. See CA Response to HHB-CA-SIR-8(b) (“While not every community concern is directly citing a concern with the GHG emissions that may be produced by the proposed project, each of the community concerns should be considered by the Commission in determining whether the proposed project is in the public interest. Thus, regardless of whether there is a direct relationship between every community concern that has been raised to GHG emissions or not, since consideration of community concerns is part of the Commission’s deliberations of whether the proposed A&R PPA should be approved, community concerns will affect whether the facility will be allowed to operate and emit GHG.” (emphasis added)); Response to HHB-CA-SIR-23(b) (“Because the assessment of public interest is not limited to GHG, global mixing does not alleviate local impacts that the Commission should consider.” (emphasis added)).

¹⁵⁵ HELCO II, 149 Hawaii at 240, 487 P.3d 7at 709 (internal quotation marks omitted) (quoting HELCO I, 145 Hawai’i at 25, 445 P.3d at 697) (emphases added).

that are not relevant and/or material to this remanded proceeding should be discouraged.

2. Tawhiri.

Despite Tawhiri's admissions that it has not conducted its own analysis with respect to GHG emissions or even pricing, Tawhiri attempts to undermine the benefits of the Project based on its apparent fear that if/when the Project comes online, it will displace Tawhiri.¹⁵⁶ The Hu Honua Project was not designed or intended to displace renewable energy generation, but rather existing fossil fuel generation.¹⁵⁷ Whether Hu Honua ultimately displaces renewable energy or fossil fuel generation is within HELCO's discretion and as guided by the Commission.

3. LOL.

LOL attempts to raise a litany of non-relevant, non-sensical issues, while refusing to elaborate on its position and support thereof.¹⁵⁸ In doing so, Hu Honua stresses that LOL has also attempted to mischaracterize the record, including by alleging in various ways that Hu Honua is hiding certain information by "black box" or "legalese mumbo jumbo."¹⁵⁹ Such bald accusations lack any evidentiary support as shown by LOL's inability to provide specific examples and citations to the record demonstrating Hu

¹⁵⁶ See Tawhiri's Response to HHB's Information Requests, filed Oct. 21, 2021, HHB-TP-IR-36(d) (agreeing that if HELCO did not curtail Tawhiri to accommodate Hu Honua's generation, "[t]his would address Tawhiri's economic concerns"); Tawhiri's Responses to HHB's Supplemental IRs, filed Nov. 18, 2021, HHB-TP-IR-33, at 18 (stating that Tawhiri has not performed its own quantitative analyses regarding the cost of generation from the proposed A&R PPA); *id.*, HHB-TP-IR-35, at 22 (stating that Tawhiri has not performed its own quantitative analysis regarding environmental benefits of HHB).

¹⁵⁷ See HHB's Response to Tawhiri's IRs, filed Oct. 21, 2021, Tawhiri-Hu Honua-IR-60, at 41 ("Hu Honua believes that renewables should be replacing existing fossil fueled sources of energy, not other renewable sources.").

¹⁵⁸ See *e.g.*, HHB's Response to LOL's Second Set of IRs, filed Dec. 5, 2019, LOL/HHB-IR-208, at 8 ("The phrase 'parasitic amount of fuel needed to extract and refine the diesel', for example, is non-sensical, vague and ambiguous, undefined, and subject to multiple interpretations and not clear whether it pertains to GHG impacts."); HHB's Memorandum in Opposition to LOL's Motion to Compel, filed Mar. 23, 2020, at 27 ("LOL's claim that any environmental, cultural, ecosystem, bird, or bat analyses, are relevant and material to the issue of where Hu Honua's feedstock is being sourced is non-sensical and clearly intended to broaden the issues in this docket.").

¹⁵⁹ See LOL's Responses to HHB-LOL-SIR-15, -16, -17, -18, -23.

Honua's lack of transparency, as requested, and are either the product of willful ignorance or a misunderstanding of the legal process.¹⁶⁰ Moreover, Hu Honua points out that despite LOL's efforts to provide its "legal" insight in a "moral and ethical sense,"¹⁶¹ LOL's position reflects an objection to renewable energy projects, which in practice means that LOL is for the status quo, which is prolonging the use of fossil fuels.

F. Hu Honua has Expended over \$500 Million in Construction and Development Costs, and the Project is 99% Complete.

Following the Commission's approval of the Project in 2017, in which the Commission indicated that further extensions to complete the Project would not be given,¹⁶² Hu Honua expended significant funds to ensure the timely completion of the Project. To this end, Hu Honua has incurred approximately \$519 million in construction and development costs, and the Project is currently **99% complete**.¹⁶³

Notwithstanding the accumulating costs to Hu Honua, which Hu Honua has incurred in good faith and in reliance upon the Commission's 2017 approval, the pricing terms under the A&R PPA (dated May 2017) remain the same.¹⁶⁴

Hu Honua remains a willing partner, if the PUC will allow it. Hu Honua's commitment to the Project, the community, and the environment should be apparent from, among other things, the over \$500 million it has already invested to bring the Project to the brink of completion. Not allowing Hu Honua to proceed will not only be disastrous for Hu Honua but also for the State of Hawaii, (1) as it would result in a chilling effect for

¹⁶⁰ See LOL's Responses to HHB-LOL-SIR-15, -16, -17, -18, -23.

¹⁶¹ See LOL's Response to HHB-LOL-SIR-23.

¹⁶² Upon the Commission's 2017 approval of the Project, the Commission instructed that it expected Hu Honua and HELCO to "make all reasonable attempts to complete the project according to this schedule and [did] not expect future requests to extend the Commercial Operation Date deadline." See 2017 D&O, at 61.

¹⁶³ See T-1, at 6; T-2 at 3; Responses to CA/Hu Honua-IR-118; -141(a).

¹⁶⁴ See T-1, at 6.

many developers looking to potentially invest into renewable energy in Hawaii (perception of Hawaii as a difficult place to do business and rely on investments made) and (2) because the Project has been anticipated by state and local government, as well as the local community, to provide the benefits of firm renewable energy generation (helping to meet the State's RPS goals and enabling, accelerating the retirement of firm fossil fuel plants, increasing energy security by using a local source of fuel, and stabilizing the price of low-cost firm energy in contrast with the volatile pricing of imported fossil fuels), contribution to grid modernization, promotion of long-term local agriculture industry, aiding in the removal and use of undesirable invasive species, facilitating a green hydrogen industry, and employment creation (through direct jobs at the Hu Honua facility and indirect forestry, harvesting and planting, and transport hauling jobs), as well as economic stimulation within the community.

III. CONCLUSION.

For the foregoing reasons, the Commission should approve the A&R PPA as reasonable, prudent, and in the public interest in consideration of the reduction of GHG emissions pursuant to HRS § 269-6(b), as amended by Act 82.

Hu Honua respectfully requests that the Commission consider the reduction in GHG emissions that will result from the approval of the A&R PPA, consistent with the Supreme Court's remand instructions in HELCO I and HELCO II, and assist the State in meeting its goal of reaching 100% RPS by 2045 by replacing existing firm dispatchable fossil fuel generation and grid services with Hu Honua's firm dispatchable renewable energy and grid services.

DATED: Honolulu, Hawaii, December 21, 2021.



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RESEARCH REVIEW

Applying a science-based systems perspective to dispel misconceptions about climate effects of forest bioenergy

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Abstract

The scientific literature contains contrasting findings about the climate effects of forest bioenergy, partly due to the wide diversity of bioenergy systems and associated contexts, but also due to differences in assessment methods. The climate effects of bioenergy must be accurately assessed to inform policy-making, but the complexity of bioenergy systems and associated land, industry and energy systems raises challenges for assessment. We examine misconceptions about climate effects of forest bioenergy and discuss important considerations in assessing these effects and devising measures to incentivize sustainable bioenergy as a component of climate policy. The temporal and spatial system boundary and the reference (counterfactual) scenarios are key methodology choices that strongly influence results. Focussing on carbon balances of individual forest stands and comparing emissions at the point of combustion neglect system-level interactions that influence the climate effects of forest bioenergy. We highlight the need for a systems approach, in assessing options and developing policy for forest bioenergy that: (1) considers the whole life cycle of bioenergy systems, including effects of the associated forest management and harvesting on landscape carbon balances; (2) identifies how forest bioenergy can best be deployed to support energy system transformation required to achieve climate goals; and (3) incentivizes those forest bioenergy systems that augment the mitigation value of the forest sector as a whole. Emphasis on short-term emissions reduction targets can lead to decisions that make medium- to long-term climate goals more difficult to achieve. The most important climate change mitigation measure is the transformation of energy, industry and transport systems so that fossil carbon remains underground. Narrow perspectives obscure the significant role that bioenergy can play by displacing fossil fuels now, and supporting energy system transition. Greater transparency and consistency is needed in greenhouse gas reporting and accounting related to bioenergy.

KEYWORDS

energy system transition, forest carbon stock, forest management, greenhouse gas accounting, landscape scale, reference system

1 | INTRODUCTION

Many countries have included support for bioenergy in their energy and climate policies, as a component of national strategies to curb greenhouse gas (GHG) emissions. However, the scientific literature shows wide variation in quantitative assessments as well as perspectives concerning the climate change mitigation effects of bioenergy, including when derived from forest biomass. Many studies have found that forest bioenergy can contribute to climate change mitigation, especially in the medium to long term (e.g. Creutzig et al., 2015; Dwivedi et al., 2019; Favero et al., 2017, 2020; Gustavsson

et al., 2017, 2021; Kilpeläinen et al., 2016; Kraxner et al., 2003; Lundmark et al., 2014; Marland & Schlamadinger, 1997; Nabuurs et al., 2017; Smyth et al., 2014; Vance, 2018). Other studies contest the climate benefits of forest bioenergy, especially in the short term (e.g. Booth, 2018; Brack, 2017; Hudiburg et al., 2011; Norton et al., 2019; Pingoud et al., 2016; Schlesinger, 2018; Soimakallio, 2014; Sterman et al., 2018). Specific areas of concern include 'carbon neutrality' assumptions, climate impacts of the growing international biomass pellet trade, timing of mitigation benefits and the treatment of bioenergy in the United Nations Framework Convention on Climate Change (UNFCCC) rules for

compiling national GHG inventories (Mather-Gratton et al., 2021). Diverging conclusions can arise from studies that consider different research questions and that use different methodologies and scope, yielding diverging results.

In this paper, we examine debated aspects related to climate impacts of forest bioenergy, in applications including heat production, electricity generation and transport. We identify factors that are relevant to understanding the climate effects of forest bioenergy, and misconceptions that can lead to conclusions that exaggerate or underestimate the effects. We discuss aspects that pertain to analysing the climate effects of forest bioenergy systems (Sections 2–11) and approaches used in GHG inventory reporting and accounting for forest bioenergy (Section 12). Our objective is to reduce confusion arising from publication of diverging studies on forest bioenergy, to inform policy development, business decisions and the public debate on bioenergy.

2 | BIOENERGY IN ENERGY SYSTEM TRANSITIONS

Global energy supply currently depends heavily on fossil fuels, with coal, oil and natural gas providing 84.3% of global primary energy use in 2019 (BP, 2020). The use of fossil fuels is projected to increase in absolute amount, despite an expected increase in the share of renewable energy sources (IEA, 2019). The most important climate change mitigation measure is the transformation of energy, industry and transport systems so that fossil carbon remains underground (IPCC, 2014, 2018; Johnsson et al., 2019; Peters et al., 2020; Tong et al., 2019). This will require a combination of measures and technologies, likely to include energy efficiency and conservation; carbon capture and storage (CCS); replacing fossil fuels with biomass-based fuels, hydrogen and e-fuels from renewable electricity; as well as non-thermal technologies such as hydro, wind and solar power supporting, inter alia, electrification of the transport sector (IPCC, 2018).

Biomass-based electricity can provide balancing power needed to maintain power stability and quality as the contribution from solar and wind power increases (Arasto et al., 2017; Lenzen et al., 2016; Li et al., 2020), complementing other balancing options such as battery storage, reservoir hydropower, grid extensions and demand-side management (Göransson & Johnsson, 2018).

Beyond its value as a dispatchable resource for electricity generation, biomass is an important option for renewable heating in buildings and industrial processes. In 2019, bioenergy contributed almost 90% of renewable industrial heat consumption and two-thirds of the total modern renewable heating and cooling in buildings and industrial processes (IEA, 2020; IRENA/IEA/REN21, 2020). It is one of the

options available to reduce emissions from heavy industries such as iron and steel production (Mandova et al., 2018, 2019) and cement production (IEA, 2018). Furthermore, carbon-based transportation fuels will remain important in the coming decades, as electrification of the transport sector will take time (IEA-AMF/IEA Bioenergy, 2020). Biofuels can contribute to reducing fossil fuel use and associated GHG emissions while there remain vehicles that use carbon-based fuels. In the longer term, biofuels will likely be used in sectors where the substitution of carbon-based fuels is difficult, such as long-distance aviation and marine transportation. As discussed in the following sections, the impact on atmospheric GHG concentrations will depend on how biomass use for bioenergy influences the land carbon stock over time.

In the Intergovernmental Panel on Climate Change (IPCC) Special Report on limiting warming to 1.5°C (SR1.5), the contribution of bioenergy to mitigation pathways is substantial, increasing to a median value of 27.3% of global energy supply in 2050 across the full range of 1.5°C pathways analysed (Rogelj et al., 2018). Various bioenergy options contribute to these mitigation pathways, including substantial use of biomass for heat and liquid fuel applications (Fuss et al., 2018). Biomass use for energy may also be combined with carbon capture and storage (BECCS) to provide carbon dioxide removal (CDR) from the atmosphere. Reaching global net zero, or net negative, GHG emissions will require CDR, to offset residual emissions in ‘hard-to-abate’ sectors. The SR1.5 found that most scenarios that achieve climate stabilization at 1.5 or 2°C warming require substantial deployment of CDR technologies, including BECCS (IPCC, 2018; Roe et al., 2019).

The finding from the global integrated assessment modelling studies included in the SR1.5 report, that bioenergy commonly has important roles in 1.5 or 2°C pathways, is not unanimously supported by studies that apply a more restricted temporal and spatial scope and use other methodological approaches than integrated assessment modelling to quantify GHG balances and climate effects. One explanation is that different methodologies capture different aspects of mitigation and systems transition. For example, indirect effects and substitution are not relevant in integrated assessment modelling, yet they are important considerations in life cycle assessment (LCA). Conversely, LCA and carbon accounting frameworks do not capture aspects such as inertia in energy/transport/industry infrastructure, and economic competition among mitigation options.

3 | ‘CARBON NEUTRALITY’ OF BIOENERGY

Bioenergy is often characterized as being ‘carbon neutral’ based on the observation that the biogenic carbon released

when biomass is combusted was previously sequestered as the plants grew, and will be sequestered again during re-growth. However, 'carbon neutrality' is an ambiguous term that is used differently in different contexts (Berndes et al., 2016). Forest biomass is sometimes said to be carbon neutral if derived from a forest system in which carbon stocks are stable or increasing. However, forest bioenergy should not be *assumed* to be carbon neutral by default. As described in methodology developed over 20 years ago for the evaluation of climate effects of bioenergy (Schlamadinger et al., 1997), both biogenic carbon flows and GHG emissions associated with the life cycle of the bioenergy system need to be considered (Section 9), and GHG emissions associated with the bioenergy system need to be compared with GHG emissions in a realistic reference situation (counterfactual scenario) where energy sources other than bioenergy are used (Section 8).

Furthermore, climate effects of forest bioenergy also depend on how bioenergy incentives influence forest management, which in turn depends on biophysical conditions and forest characteristics, prevailing forest management practices, the character and product portfolio of the associated forest industry, alternative land use options and land owners' expectations of forest product markets (Abt et al., 2012; Buchholz et al., 2019; Eggers et al., 2014; Johnston & van Cooten, 2016; Levers et al., 2014; Nepal et al., 2019; Nielsen et al., 2020; Sedjo & Tian, 2012; Tærø et al., 2017; Trømborg & Solberg, 2010). Studies that include economic factors and consider the diversity and dynamic characteristics of forests and the wood products sector reveal that the effects of forest bioenergy incentives on the development of forest carbon stocks can be positive or negative, depending on the situation and management response (Baker et al., 2019; Cintas, Berndes, Hansson, et al., 2017; Costanza et al., 2017; Daigneault et al., 2012; Dale et al., 2017; Duden et al., 2017; Dwivedi et al., 2019; Gustavsson et al., 2017; Hudiburg et al., 2011; Kallio et al., 2013; Khanna et al., 2017; Kim et al., 2018; Law et al., 2018; Nabuurs, Delacote, et al., 2017; Pingoud et al., 2016; see also Section 6). Thus, the possible trade-off between storing carbon in the forest and harvesting the forest for wood products needs to be considered, along with other objectives, when strategies for climate change mitigation are developed (Berndes et al., 2018; Kurz et al., 2016). The concept of climate-smart forestry is an example of a strategy recognizing this. It seeks to integrate climate objectives across the value chain from forest to wood products and energy, with the aims to (i) sustainably increase forest productivity; (ii) reduce GHG emissions and remove carbon from the atmosphere; and (iii) support adaptation and build resilience to climate change (Nabuurs, Delacote, et al., 2017; Nabuurs et al., 2019).

The treatment of bioenergy in UNFCCC reporting is sometimes described as 'assuming carbon neutrality' because CO₂ emissions from bioenergy are reported as zero in

the energy sector. This may appear to be an inaccurate simplification; however, this approach is necessary to avoid double counting, because all carbon emissions associated with forest harvest are already counted in the 'Land use, land-use change and forestry' sector (see Section 12).

4 | PAYBACK TIME AND CLIMATE TARGETS

If forest management is adapted to provide biomass for energy in addition to other forest products, this influences the magnitude and timing of carbon sequestration and emissions in the forest, which in turn influences the scale and timing of the climate effect (Cowie et al., 2013). Concepts such as 'carbon debt' and 'payback time' have been raised in the context of land use change emissions associated with expansion of energy crops (Fargione et al., 2008; Gibbs et al., 2008), and also in relation to forest bioenergy, where the magnitude and timing of forest carbon sequestration and emissions is the concern. Wide variation in published estimates of payback time for forest bioenergy systems reflects both inherent differences between these systems and different methodology choices (Bentsen, 2017; Buchholz et al., 2016; Cintas et al., 2016; Hanssen et al., 2017; Lamers & Junginger, 2013; Ter-Mikaelian et al., 2015; Ter-Mikaelian, Colombo, Lovekin, et al., 2015). Critical methodology decisions include the definition of spatial and temporal system boundaries (see Sections 7 and 11) and reference (counterfactual) scenarios (see Section 8).

Some authors (e.g. Booth, 2018; Brack, 2017; Norton et al., 2019) propose that forest bioenergy should only receive support under renewable energy policies if it delivers net reduction in atmospheric CO₂ within about a decade, due to the urgent need to reduce GHG emissions. However, besides the subjectivity of payback time analysis raised above, applying a 10-year payback time as a criterion for identifying suitable mitigation options is inconsistent with the long-term temperature goal of the Paris Agreement, which requires that a balance between emission and removals is reached in the second half of this century (Tanaka et al., 2019). Furthermore, it reflects a view on the relationship between net emissions, global warming and climate stabilization that contrasts with the scenarios presented in the SR1.5: The report shows many alternative trajectories towards stabilization temperatures of 1.5 and 2°C warming that reach net zero at different times and require different amounts of CDR (IPCC, 2018). The IPCC report did not determine that individual mitigation measures must meet specific payback times, but rather that a portfolio of mitigation measures is required that together limits the total cumulative global anthropogenic emissions of CO₂. Furthermore, applying a payback time criterion when evaluating forest

bioenergy, and determining the contribution of bioenergy to meeting the Paris Agreement temperature goal, is complicated by the fact that bioenergy systems operate within the biogenic carbon cycle (see Section 3), which implies a fundamentally different influence on atmospheric CO₂ concentrations over time compared to fossil fuel emissions (Cherubini et al., 2014).

The IPCC emphasizes the need for transformation of all sectors of society to achieve the 'well below 2°C' goal of the Paris Agreement (IPCC, 2018). This will entail technology and infrastructure development to generate a portfolio of emissions reduction and CDR strategies. Such investments may include, for example, scaling-up battery manufacturing to support electrification of car fleets, building rail infrastructure and district heating networks and changing the management and harvesting of forests and other lands to provide biomass for biobased products. The mobilization of mitigation options such as these can initially increase net GHG emissions while providing products and services with low, neutral or net negative emissions in the longer term (Cuenot & Hernández, 2016; Hausfather, 2019). The contribution of specific options to mitigation will depend on technology readiness level, costs, resource availability and inertia of existing technologies and systems. Options assessed as having low net GHG emissions per unit energy provided may be restricted by immature development, high cost or dependence on new infrastructure. Other options, including bioenergy, have greater near-term mitigation potential due to being compatible with existing infrastructure and cost competitive in many applications.

Strategy development needs to recognize the complementarity of many mitigation options, and balance trade-offs between short- and long-term emissions reduction objectives. Critically, strategies based on assessments of individual technologies in isolation from their broader context, and that apply a strong focus on emissions reduction in the short term, can make long-term climate goals more difficult to achieve (e.g. Berndes et al., 2018; Smyth et al., 2014). Mitigation options available in the near term need to be evaluated beyond the direct effect on GHG emissions, considering also their influence on systems transition and implementation of other mitigation options (see Section 2).

Risks related to climate tipping points are sometimes raised in relation to the timing of GHG savings: crossing thresholds, for example, associated with forest dieback or thaw of permafrost, could lead to large, irreversible changes in the global climate system (e.g. Grimm et al., 2013). A recent study found a low probability of crossing a tipping point in the global climate system if warming does not exceed 2°C (Fischer et al., 2018). Also, critical threshold values and irreversibility of specific tipping points are uncertain (Collins et al., 2013), and the universal application of critical threshold values is questioned in relation to ecosystem function

(Hillebrand et al., 2020). Nevertheless, uncertainties and risks associated with climate tipping points are additional considerations in evaluations of different trajectories towards temperature stabilization. Rather than connecting the timing of GHG savings to specific but uncertain climate tipping points, evaluation of bioenergy options is preferably based on a holistic assessment that considers how bioenergy can contribute to resilience and adaptation to changes in climate along with other environmental stressors.

5 | EMISSIONS OF BIOGENIC VERSUS FOSSIL CARBON

Some scientific papers state that burning biomass for energy produces higher emissions of CO₂ per kWh of electricity at the smoke-stack compared with burning coal due to lower energy density of wood and/or less efficient conversion to electricity (e.g. Brack, 2017; Norton et al., 2019; Searchinger et al., 2018; Sterman et al., 2018; Walker et al., 2013), leading to the assertion that 'biomass is worse for the climate than coal' (Johnston & van Kooten, 2015; McClure, 2014; PFPI, 2011; RSBP, 2012; Tsanova, 2018; Yassa, 2017). However, this interpretation neglects several significant factors.

First, stack emissions will not necessarily increase when there is a shift to biomass fuels. The CO₂ emission factor (g CO₂ per GJ of fuel) is solely dependent on the chemical composition of the fuel. Wood and coal have similar CO₂ emission factors, as the ratio of heating values between the two fuels is similar to the ratio of carbon content (ECN, undated; Edwards et al., 2014; US EPA, 2018; van Loo & Koppejan, 2008). Where biomass is co-fired with coal in large power plants, the conversion efficiency may decrease a few percent, although there is usually no significant efficiency penalty when the co-firing ratio is below 10% (van Loo & Koppejan, 2008). Conversion efficiencies depend on fuel properties including moisture content and grindability in addition to heating value (Mun et al., 2016; Shi et al., 2019; Zuwała & Lasek, 2017). For low rank coal, biomass co-firing (especially torrefied biomass) can increase the boiler efficiency and net power plant efficiency (Liu et al., 2019; Thrän et al., 2016).

Smaller biomass-fired plants can have lower electric conversion efficiency than large coal-fired plants, but as they are typically combined heat and power plants, they also displace heat production from other sources, that could otherwise have generated fossil fuel emissions (e.g. Madsen & Bentsen, 2018). Large dedicated biomass units (converted from coal) can operate with roughly the same level of thermal efficiency as delivered historically from coal (Koss, 2019). For example, stack emissions from the Drax power station in the United Kingdom have been independently estimated at 2% higher for biomass than coal (SIG, 2017).

Second, and much more important, comparing GHG emissions from biomass and fossil fuels at the point of combustion ignores the fundamental difference between fossil fuels and biomass fuels. Burning fossil fuels releases carbon that has been locked up in the ground for millions of years. Fossil fuel emissions transfer carbon from the lithosphere to the biosphere–atmosphere system, causing temperature increases that are irreversible on timescales relevant for humans (Archer et al., 2009; Solomon et al., 2009; Ter-Mikaelian, Colombo, & Chen, 2015). In contrast, bioenergy operates within the biosphere–atmosphere system, and burning biomass emits carbon that is part of the continuous exchange of carbon between the biosphere and the atmosphere (Smith et al., 2016). Therefore, the effect on the atmospheric CO₂ concentration of switching from fossil fuels to biomass cannot be determined by comparing CO₂ emissions at the point of combustion (Nabuurs, Arets, et al., 2017; Schlamadinger et al., 1997). To do so essentially equates biomass harvest with deforestation to establish another land use, such as agriculture or urban infrastructure, causing permanent transfer of carbon from land to atmosphere.

6 | SOURCING BIOMASS FOR BIOENERGY, AND EFFECTS ON FOREST MANAGEMENT AND FOREST CARBON BALANCE

The source of forest biomass is a key determinant of climate change effects of bioenergy (Matthews et al., 2018). Concerns have been raised that bioenergy demand could lead to widespread harvest of forests solely for bioenergy, causing large GHG emissions and forgone carbon sequestration (Brack, 2017; Norton et al., 2019; Searchinger et al., 2018). However, long-rotation forests are generally not harvested for bioenergy products alone: Biomass for bioenergy is usually a by-product of sawlog and pulpwood production for material applications (Dale et al., 2017; Ghaffariyan et al., 2017; Spinelli et al., 2019; Figure 1). Logs that meet quality requirements are used to produce high-value products such as sawnwood and engineered wood products such as cross laminated timber, which can substitute for more carbon-intensive building materials such as concrete, steel and aluminium

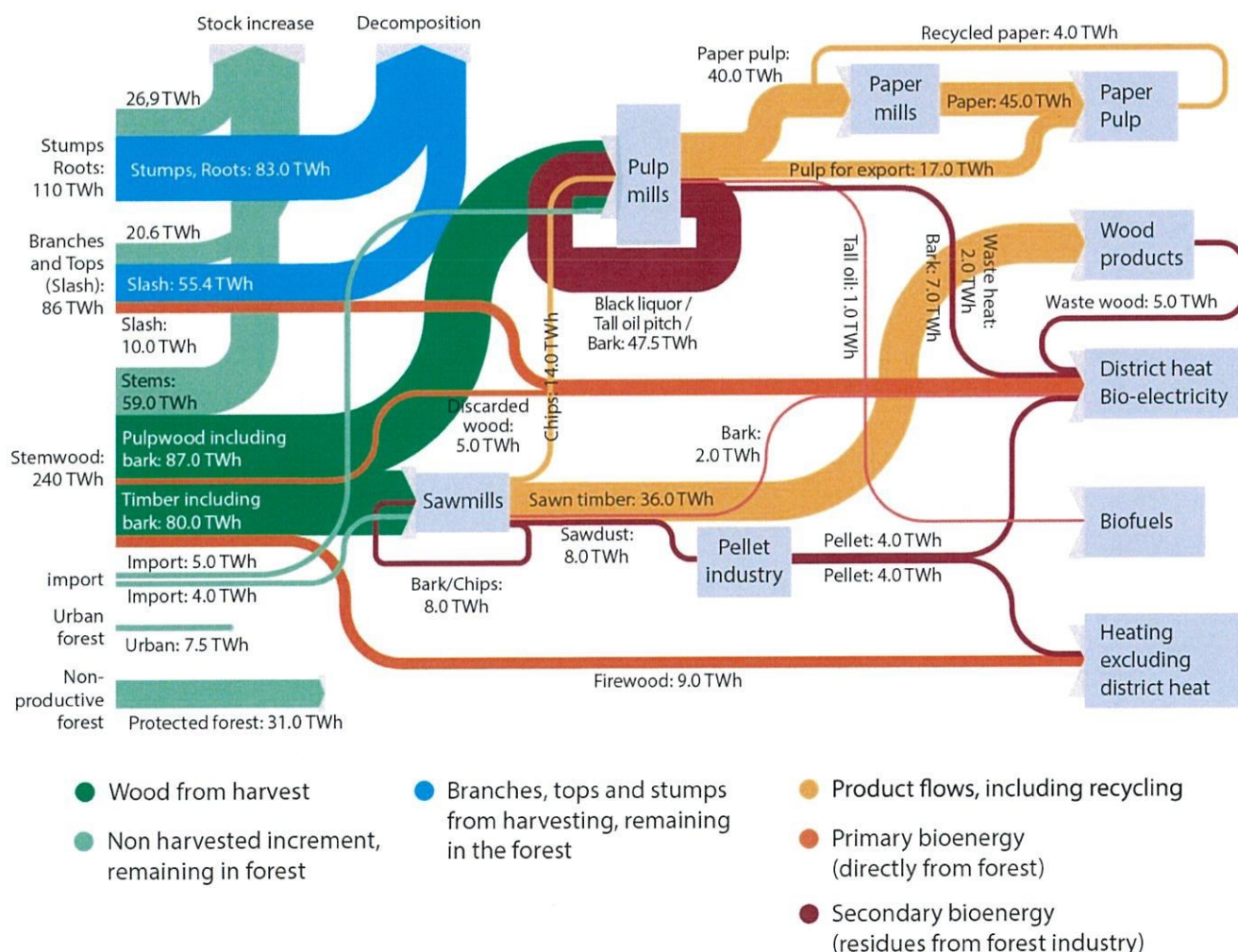


FIGURE 1 Biomass and energy flows from Swedish forest
Source: IRENA, 2019

(Leskinen et al., 2018). Residues from forestry operations (tops, branches, irregular and damaged stem sections, thinnings) and wood processing residues (e.g. sawdust, bark, black liquor) are used for bioenergy (Kittler et al., 2020), including to provide process heat in the forest industry (Hassan et al., 2019). These biomass sources have high likelihood of reducing net GHG emissions when substituting fossil fuels (Hanssen et al., 2017; Matthews et al., 2018), and their use for bioenergy enhances the climate change mitigation value of forests managed for wood production (Cintas, Berndes, Hansson, et al., 2017; Gustavsson et al., 2015, 2021; Schulze et al., 2020; Ximenes et al., 2012). Part of the forest biomass used for bioenergy comprises roundwood (also referred to as stemwood), such as small stems from forest thinning. For example, roundwood was estimated to contribute around 20% of the feedstock used for densified wood pellets in the United States in 2018 (US EIA, 2019).

The capacity of the world's managed forests to sustainably supply biomass is limited, both in terms of rate of increase and absolute potential, and lower than the future biomass demand in many scenarios that achieve climate stabilization at 1.5 or 2°C warming. The GHG consequences of increasing the biomass supply depend on how this is done, as there can be synergies and trade-offs between forest growth rate, forest carbon stocks and production of biomass and other wood products (e.g. Wang et al., 2015). The critical question is how the net GHG emissions change when the forest sector devises management approaches that enable biomass production for energy in conjunction with supply of sawlogs and pulpwood. One option is to use more residues from forestry operations and wood processing (Egnell & Björheden, 2013). Another option could involve increase in the harvest of roundwood,

which could diminish the mitigation value if forest carbon stocks and forest sink strength are decreased, such as due to a rapid increase in roundwood harvest rates (Agostini et al., 2014; Kallio et al., 2013; Olesen et al., 2015; Pingoud et al., 2018).

Expectation of increasing biomass demand could stimulate establishment of new forests to secure future wood production, which would provide additional carbon storage, and motivate management changes in existing forests to enhance growth (e.g. improved site preparation, faster growing tree species, fertilization), which could improve the climate outcomes from forests managed for biomass and other products (Favero et al., 2020; Galik & Abt, 2012; Kauppi et al., 2020; Laganière et al., 2017). For example, in Sweden, which was widely deforested in the 1800s, forest expansion together with intensive forest management has doubled the standing volume of forests over the last 100 years, at the same time as annual harvest has increased (Figure 2). This outcome was supported by forest policy that ensures harvest does not exceed growth, and forests are regenerated after harvest (Eriksson et al., 2018). A similar trend of increased forest carbon stock with simultaneous increase in harvest has occurred in Denmark (Nord-Larsen et al., 2020), Finland (Luke, 2017) and in the southeast United States (Aguilar et al., 2020).

The existence of a bioenergy market can improve the financial viability of forest thinning (Cintas et al., 2016), which stimulates production of high-quality timber with the aforementioned climate benefits from product substitution. In addition, extracting (otherwise unutilized) lower quality biomass (e.g. resulting from pest and disease impacts or overstocking) can reduce the frequency and severity of wildfires and associated loss of forest

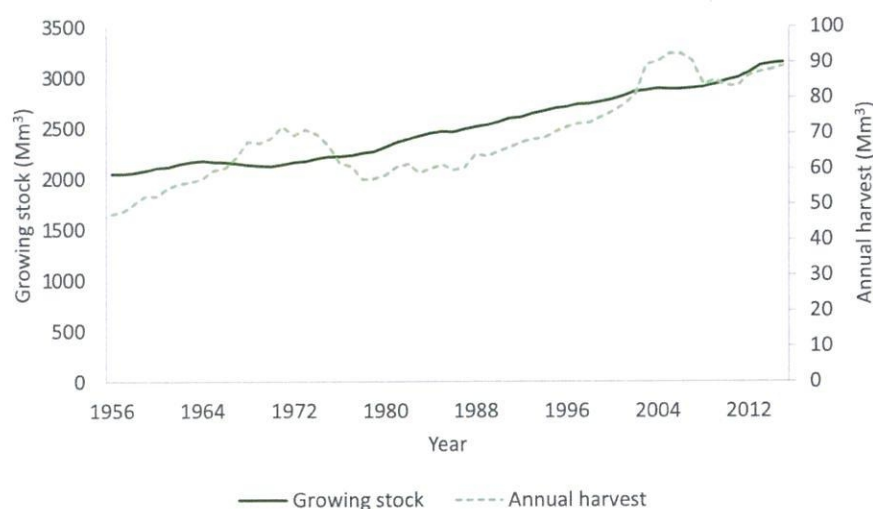


FIGURE 2 Forest stock and annual harvest in Sweden. Growing stock and annual harvest on managed forest land in Sweden 1955–2015 (5-year moving average). Excl. national parks, nature reserves and nature protection areas. The peaks in harvest levels coincide with major storm damage in 1969, 2005 and 2007, followed by bark beetle damage and consequently salvage logging

Source: Swedish National Forest Inventory, Swedish Forest Agency Swedish University of Agricultural Sciences

carbon and release of non-CO₂ GHGs, further enhancing the climate benefit (Agee & Skinner, 2005; Evans & Finkral, 2009; Mansuy et al., 2018; Regos et al., 2016; Sun et al., 2018; Verkerk et al., 2018). On the other hand, the mitigation value of forest bioenergy could be diminished if policies supporting bioenergy reduce timber availability for material applications (Favero et al., 2020), thereby reducing the wood products pool and increasing use of GHG-intensive materials; if excessive removal of residues reduces forest productivity (Achat et al., 2015; Helmisaari et al., 2011); or if reforestation displaces food production and results in deforestation elsewhere to provide new cropland.

In some situations, such as high latitudes where forest productivity is very low, greater abatement may result from retaining and enhancing forest carbon stocks than harvesting forests for wood products including bioenergy, especially if the GHG savings from bioenergy use are small (Marland & Schlamadinger, 1997; Schlamadinger & Marland, 1996a). The choice to manage for in-forest carbon sequestration alone or for wood products should also consider a broader range of impacts beyond climate, to identify and manage trade-offs and synergies such as between carbon sequestration and biodiversity (Kline & Dale, 2020).

The argument has been made that bioenergy contributes to climate change mitigation only if obtained from 'additional' biomass, defined as biomass grown in excess of that which would have grown anyway or residues that would otherwise decompose, precluding biomass obtained from existing forests if there is a decline in forest carbon stock (Haberl et al., 2012; Schlesinger, 2018; Searchinger et al., 2009). However, using forest biomass for bioenergy will give a climate benefit if the stock reduction is smaller than the net GHG savings from displacement of fossil fuels. The biomass produced cumulatively across subsequent rotations can far exceed the biomass produced in the no-bioenergy scenario, thus constituting 'additional biomass', delivering cumulative net GHG savings that exceed the GHG cost of forest carbon stock reduction (Cowie et al., 2013). This is particularly the case where active management maintains high forest growth (i.e. a strong carbon sink), allowing sustained harvesting.

7 | STAND VERSUS LANDSCAPE SCALE ASSESSMENT

Some studies of forest bioenergy consider carbon dynamics at the individual stand level (e.g. Cherubini et al., 2011; Holtsmark, 2015; Pingoud et al., 2012; Schlamadinger & Marland, 1996b; Walker et al., 2013). Stand-level assessments represent the forest system as a strict sequence of events (e.g. site preparation, planting or natural regeneration, thinning and other silvicultural operations, final felling). Results

are strongly influenced by the starting point: commencing the assessment at harvest shows upfront emissions, followed by a CO₂ removal phase, giving a delay before forest bioenergy contributes to net reductions in atmospheric CO₂, particularly in long-rotation forests. This delay has been interpreted as diminishing the climate benefit of forest bioenergy (e.g. Holtsmark, 2013; Norton et al., 2019; Sandbag, 2019). In contrast, commencing at the time of replanting shows the opposite trend: a period of CO₂ removal during forest growth, followed by a pulse emission returning the CO₂ to the atmosphere. Thus, stand-level assessments give inconsistent results and can be misleading as a basis to assess climate impacts of forest systems (Berndes et al., 2013; Cintas, Berndes, Cowie, et al., 2017; Peñaloza et al., 2019). Furthermore, when considering only the stand level, it is difficult to identify whether the forest is sustainably managed or subject to unsustainable practices that cause declining productive capacity and decreasing carbon stocks.

Note that we are referring to even-aged stands, harvested by clear-cutting at the rotation age. This management approach differs from selective logging, also known as continuous cover forestry. The temporal carbon stock fluctuations at stand level are less extreme under selective logging, but the same considerations apply when assessing the climate effects of forest bioenergy.

The alternative to stand level is landscape-scale assessment, that considers the total area of managed forests. Stand- and landscape-level assessments respond to different questions. Stand-level assessment provides detailed information about plant community dynamics, growth patterns and interactions between carbon pools in the forest. But the stand-level perspective overlooks that forests managed for wood production generally comprise a series of stands of different ages, harvested at different times to produce a continuous supply of wood products. Across the whole forest landscape, that is, at the scale that forests are generally managed, temporal fluctuations observed at stand level are evened out and the forest carbon stock fluctuates around a trend line that can be increasing or decreasing, or roughly stable, depending on the age class distribution and weather patterns (Cowie et al., 2013). Landscape-level assessment provides a more complete representation of the dynamics of forest systems, as it can integrate the effects of all changes in forest management and harvesting taking place in response to—experienced or anticipated—bioenergy demand, and it also incorporates the effects of landscape-scale processes such as fire (Cintas et al., 2016; Cowie et al., 2013; Dwivedi et al., 2019; Koponen et al., 2018; Peñaloza et al., 2019).

In undertaking a landscape-level assessment, a constant spatial boundary should be applied, rather than an expanding boundary in which stands are added sequentially, in order to accurately reflect how the management changes affect the carbon stock in the whole landscape over time

(Cintas, Berndes, Cowie, et al., 2017). A forest landscape can be modelled as a series of identical time-shifted stands, for example, an ideal forest with uniform age distribution, with the same number of stands as the number of years in the rotation period. Alternatively, if data are available, models can also be used to represent real forest landscapes, which usually have unequal distributions of age classes and stands of different sizes (e.g. Cintas, Berndes, Cowie, et al., 2017).

A forested area often also includes areas that are unharvested, for example, to comply with conservation regulations or best practices. If the management, size and conditions of these areas are identical in the 'with bioenergy' and 'without bioenergy' scenarios, then they can be excluded when estimating effects of forest management on climate change mitigation. However, there could be differences, for example, if forests actively managed for bioenergy are less prone to wildfire and disease, which can otherwise spread into and damage neighbouring forest reserves (Kline et al., 2021).

In a forest managed such that annual carbon losses due to harvest plus other disturbances and natural turnover equal the annual growth in the forest, there is no change in forest carbon stock when considered at landscape level (Jonker et al., 2014). If incentives for bioenergy lead to an increase in the fraction of annual growth extracted, then landscape-scale forest carbon stocks can decline, or can increase at a slower rate than the no-bioenergy scenario, until a new equilibrium is reached between harvest and growth (Heinonen et al., 2017; Kallio et al., 2013; Soimakallio et al., 2016). Any reduction in forest carbon stock in the new equilibrium relative to the no-bioenergy scenario reduces the climate benefit of bioenergy. Forest management that enhances forest growth (See Section 6) could moderate negative impacts on forest carbon stock under the bioenergy scenario (Cowie et al., 2013; Favero et al., 2020; Gustavsson et al., 2017; Jonker et al., 2018; Khanna et al., 2017; Sathre et al., 2010; Sedjo & Tian, 2012).

To conclude, impacts of bioenergy policy should be assessed at the landscape scale because it is the change in forest carbon stocks at this scale, due to change in management to provide bioenergy along with other forest products, that determines the climate impact. Understanding of stand-level dynamics is critical to forest management and is useful to inform assessments at the landscape scale. Studies of real forest landscapes show that the net GHG effects of bioenergy incentives are more variable than suggested by studies that do not consider economic factors and varying conditions in the forest and wood products sector.

8 | REFERENCE SYSTEM (COUNTERFACTUAL)

To determine the climate effects of forest bioenergy, it is necessary to compare the bioenergy scenario with a

reference 'no-bioenergy' scenario (Gustavsson et al., 2000; Schlamadinger et al., 1997) that delivers the same services to society. The reference land use is a critical methodological decision (Dwivedi et al., 2019; Johnson & Tschudi, 2012; Koponen et al., 2018). Some studies assess unharvested forest as one (and sometimes the only) reference scenario (e.g. Haus et al., 2014; Holtmark, 2015; Lamers et al., 2014; Mitchell et al., 2012; Pingoud et al., 2012; Soimakallio et al., 2016) and attribute extra GHG emissions to the bioenergy system based on forgone sequestration in comparison with natural regeneration. Others use a historical baseline reference point, without considering the dynamic nature of carbon stocks under a no-bioenergy scenario (see Buchholz et al., 2016). However, to accurately quantify the consequences of forest bioenergy, the reference land use should represent the land carbon stock trajectory under the most likely land use(s) in the absence of bioenergy (Koponen et al., 2018; Lamers & Junginger, 2013; Parish et al., 2017). For biomass obtained as a co-product from forests managed for timber production, the relevant reference is commonly management for timber only, with thinning and harvest residues decomposing (or burned) on-site (Hanssen et al., 2017). In some situations, the most likely reference land use could involve land use change. For example, markets for wood products can be an important incentive for private landowners to retain land as managed forest rather than converting to other uses (Hodges et al., 2019); the reference scenario in this situation may involve: regeneration of natural forest, possibly subject to higher incidence of wildfire; replacement of forest stands with agriculture; or urbanization, each with different impacts on the land carbon stock (Parish et al., 2017; Wear & Greis, 2013). Assuming the forest would remain unharvested in the no-bioenergy scenario is not a realistic reference in situations where landholders use the land to generate income, unless landholders can obtain equivalent income from payments for carbon sequestration or other ecosystem services (Srinivasan, 2015). In cases where a no-harvest scenario is a valid reference case, there are challenges in quantifying future carbon stocks: carbon sequestration rate in unharvested forests, especially in the longer term, is uncertain in many cases due to a paucity of relevant data (e.g. Derderian et al., 2016) and uncertain effects of climate change. Furthermore, accumulated carbon is vulnerable to future loss through disturbances such as storm, drought, fire or pest outbreaks. Where more than one alternative is plausible, it is informative to analyse several alternative reference land-use scenarios (Koponen et al., 2018).

The reference system also needs to describe the wood products flow in the absence of bioenergy, as bioenergy incentives may influence the quantity and assortment of wood products available (see Section 6), and could divert biomass from non-energy uses such as pulp or composite products (Cowie & Gardner, 2007; Wang et al., 2015). The alternative

fate of biomass residues and waste in the reference case could involve decomposition, incineration or landfilling, each with different emissions implications.

The reference no-bioenergy scenario should also identify the reference energy system assumed to be displaced by bioenergy, which is commonly based on fossil fuels (see Section 2). Displacing natural gas gives less benefit due to its lower GHG intensity compared with coal, and oil typically lies between them. A multitude of energy sources and technologies including fossil and renewable sources can be used for generation of electricity and heat for power grids and heat networks, varying geographically and over time, which can make it difficult to determine the energy source displaced by bioenergy (Bentsen, 2017; Soimakallio et al., 2011). Uncertainty in the rate of uptake and rate of technological improvements of other renewables makes it hard to characterize the appropriate reference energy system in the medium and long term. It is likely, however, that fossil fuels will continue to be used, and displaced on the margin, for a considerable time (IEA, 2019).

9 | SUPPLY CHAIN EMISSIONS

It is commonly perceived that bioenergy supply chain emissions are substantial, particularly when biomass is transported internationally, and could negate the climate benefits of fossil fuel substitution. However, fossil energy use along domestic forest biomass supply chains, from harvest, processing and transport, is generally small compared to the energy content of the bioenergy product and, with efficient handling and shipping, even when traded internationally (Batidzirai et al., 2014; Dwivedi et al., 2014; Ehrig & Behrendt, 2013; Gustavsson et al., 2011; Hamelinck et al., 2005; Jonker et al., 2014; Mauro et al., 2018; Miedema et al., 2017; Porsö et al., 2018; Uslu et al., 2008). The European Commission's Joint Research Centre determined that shipping pellets between North America and Europe increases supply chain emissions by 3–6 g CO₂/MJ, from around 3–15 g CO₂/MJ for wood chips or pellets dried using bioenergy and transported 500 km by truck (Giuntoli et al., 2017). For context, the EU average emission factors for hard coal are 96 and 16 g CO₂/MJ for combustion and supply respectively (Giuntoli et al., 2017). This underscores the importance of assessing actual supply chains. For example, the international pellet supply chain between the southeast United States and Europe has been intentionally designed to minimize trucking and associated handling costs, with pellet mills and large end users such as power plants located near rail lines, waterways and ports, thereby minimizing transport emissions and increasing net climate benefits (Dwivedi et al., 2014; Favero et al., 2020; Kline et al., 2021).

10 | NON-CO₂ CLIMATE FORCERS

The climate effects of forest-based bioenergy can be augmented or diminished by associated changes in biophysical properties of land, such as surface albedo, emissions of biogenic volatile organic compounds, surface roughness, evapotranspiration and sensible heat fluxes that directly or indirectly affect climate (e.g. Anderson et al., 2011; Bonan, 2008; Favero et al., 2018; Lutz & Howarth, 2015; Luyssaert et al., 2018). These effects are complex and highly dependent on location, tree species and management practice, and have implications for global as well as regional and local climate (e.g. Arora & Montenegro, 2011; Jia et al., 2019). Inclusion of non-CO₂ climate forcers can significantly influence assessments of forest bioenergy, particularly in areas with seasonal snow cover (e.g. Arvesen et al., 2018), although the warming and cooling effects of non-CO₂ forcers can also counteract each other (e.g. Kalliokoski et al., 2020). These factors need further study to understand their climate effects and develop agreed methodology for their quantification.

11 | SIGNIFICANCE OF THE SYSTEM BOUNDARY

Studies evaluating climate effects of forest-based bioenergy have produced divergent results due to inherent differences between bioenergy systems and different analytical approaches and assumptions (Cherubini et al., 2009). As discussed above, the choice of spatial system boundary and temporal scope is critical (Cherubini et al., 2009; Gustavsson et al., 2000; Marland, 2010; Schlamadinger et al., 1997) and should be coherent with the question studied (Koponen et al., 2018). Figure 3 illustrates alternative system boundaries that have been applied in studies of forest-based bioenergy. Focus on stack emissions (Option 1) neglects the key differences between fossil and biogenic carbon (see Section 3). Focus on the forest only (Option 2) captures the effects of biomass harvest on forest carbon stocks (see Section 6) but omits the climate benefits of displacing fossil fuels. Option 3, the biomass supply chain, overlooks the interactions between biomass and other forest products (Section 6). Option 4 covers the whole bioeconomy, that is, the forest, the biomass supply chain and all bio-based products from managed forests, and thus provides a more complete assessment of the climate effects of forest bioenergy.

In order to quantify the net climate effect of forest bioenergy, assessments should take a whole systems perspective. While this increases the complexity and uncertainty of the assessments, it provides a sound basis for robust decision-making. Biomass for bioenergy should be considered as one component of the bioeconomy (Option 4, Figure 3). Studies should therefore assess the effects of increasing biomass

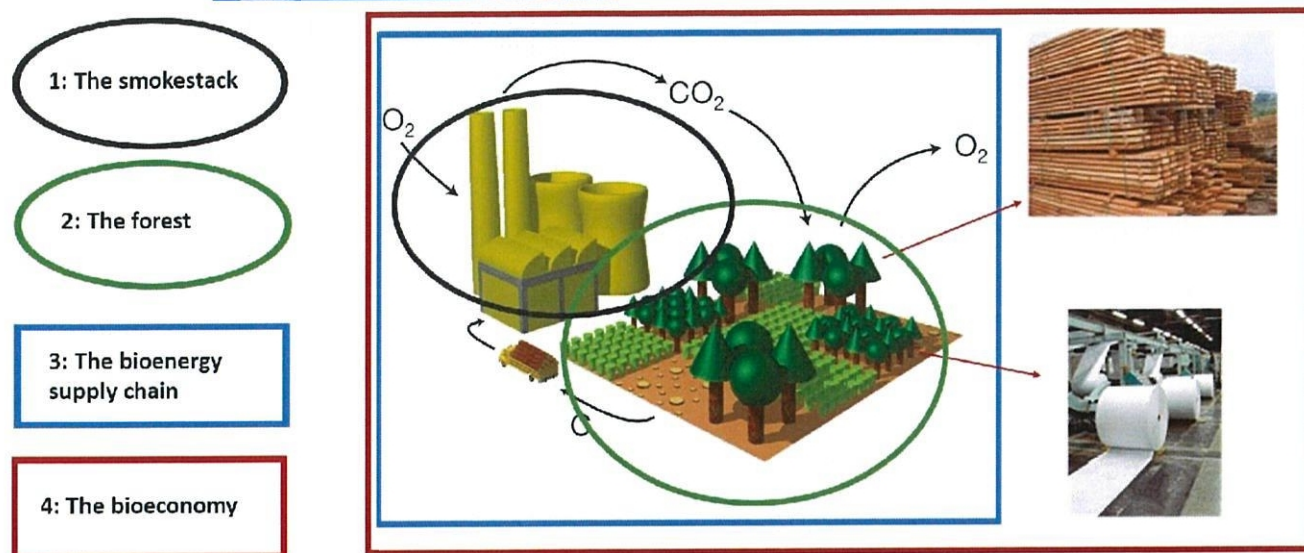


FIGURE 3 Alternative system boundaries that have been applied in studies assessing climate effects of forest-based bioenergy. Option 1 (black) considers only the stack emissions; Option 2 (green) considers only the forest carbon stock; Option 3 (blue) considers the bioenergy supply chain; Option 4 (red) covers the whole bioeconomy, including wood products in addition to biomass

demand for bioenergy on carbon stocks of the whole forest, and also include the broader indirect impacts on emissions (potentially positive or negative) due to policy- and market-driven influences on land use, use of wood products and GHG-intensive construction materials, and fossil fuel use, outside the bioenergy supply chain. The bioenergy system should be compared with a realistic counterfactual(s) that includes the reference land use and energy systems (Cherubini et al., 2009; Koponen et al., 2018; Schlamadinger et al., 1997). This approach is consistent with consequential LCA (Brandão et al., 2017). The temporal boundary should recognize: forest carbon dynamics, for example, modelling over several rotations; the trajectory for energy system transition; and short- and long-term climate objectives. Matthews et al. (2018) suggest criteria that could be used to identify woody biomass with greater climate benefits when assessed from a full life cycle, whole system perspective.

12 | REPORTING AND ACCOUNTING FOR BIOENERGY

The discussion above focusses on methodologies and results of studies assessing the climate effects of increased demand for forest bioenergy, considering GHG emissions and removals across the life cycle of bioenergy systems including the forest and co-product impacts, and comparison with a no-bioenergy counterfactual. Another context in which GHG emissions and removals associated with bioenergy are relevant is country-level reporting and accounting under the UNFCCC, and this is another aspect debated in the literature. In the UNFCCC context, the terms ‘reporting’ and

‘accounting’ have specific meaning: *Reporting* refers to the national inventories of annual GHG emissions and removals that parties submit to the UNFCCC, whereas *accounting* pertains to comparing GHG emissions with commitments, initially under the Kyoto Protocol (2008–2020; Cowie et al., 2006), and now the Paris Agreement.

The UNFCCC reporting requirements specify that CO₂ emissions associated with biomass combustion are counted in the land use sector, that is, where the harvest takes place; they are therefore reported as zero in the energy sector to avoid double-counting (Goodwin et al., 2019). This reporting approach is accurate, has no gaps and does not assume that bioenergy is carbon neutral (Haberl et al., 2012; Marland, 2010), although it has sometimes been described as such (e.g. Norton et al., 2019; Searchinger et al., 2009). Decisions on the approach to reporting and accounting for bioenergy and other wood products were informed by consideration of impacts on incentives for forest harvest and trade in wood products, practicality of calculation and data availability (Cowie et al., 2006; Höhne et al., 2007; Houghton et al., 1997 Vol 3; Lim et al., 1999; Penman et al., 2003; Sato & Nojiri, 2019; Schlamadinger et al., 2007). As explained by Rüter et al. (2019), emissions associated with wood products including bioenergy may be reported by the producing or consuming country, and may be based on carbon stock change in the forest or in the wood products pool, depending on the approach chosen by each party for reporting of harvested wood products (HWP). While the UNFCCC reporting approach is theoretically sound, incomplete coverage of the Kyoto Protocol created a gap in *accounting*: if an Annex I party (i.e. country with a Kyoto Protocol commitment) imported forest biomass from a country with no Kyoto Protocol commitment, any

associated stock change in the forest of the exporting country was not accounted. The issue of incomplete coverage for accounting could potentially have been overcome under the Paris Agreement, as all parties now have targets (their nationally determined contributions, NDCs) against which they are required to account. However, the disparity in sectors and emission sources covered in countries' NDCs, and inconsistency in the HWP accounting approach applied, perpetuates risks of double-counting or omissions (Rüter et al., 2019; Sato & Nojiri, 2019). Within a country, the forest accounting approach used in the second commitment period of the Kyoto Protocol (2013–2020) allowed a policy-driven increase in harvest, such as resulting from an increase in bioenergy, to be included in a country's 'forest management reference level', and therefore not counted as a debit in the land sector (Grassi et al., 2018). Grassi et al. (2018) proposed an accounting approach using continuation of historical forest management as the reference to avoid the loophole of unverified counterfactuals, which has been adopted by the EU under Regulation 2018/841 of the EU Climate and Energy Framework (Camia et al., 2021). Several authors (Brack, 2017; Hudiburg et al., 2019; Norton et al., 2019) propose changing the UNFCCC accounting rules by which biomass is treated as having zero emissions at the point of combustion. However, accounting for CO₂ emissions from bioenergy within the energy sector would require revision of the established GHG accounting framework to adjust the land sector values to remove the component related to biomass used for energy, to avoid double-counting of emissions, which would be very difficult to achieve, as explained by Camia et al. (2021). It would create a disincentive for countries to utilize biomass to displace fossil fuels, adversely affecting all types of bioenergy systems irrespective of their potential to provide climate benefits (Pingoud et al., 2010). Rather than changing the accounting convention solely for bioenergy, a flux-based 'atmospheric flow approach' (Rüter et al., 2019) could potentially be applied to all wood products. However, if carbon fluxes from all wood products were to be reported at the time and place of emission, emissions due to forest harvest for export would not be reported by the country where the harvest takes place, thereby removing incentives for maintaining forest carbon stocks and potentially leading to deforestation because the country where the harvest takes place would report no emissions. Furthermore, reporting only at the time and place of emission would create a disincentive for use and trade in all sustainable wood products, including use for construction and bioenergy (Apps et al., 1997; Cowie et al., 2006; UNFCCC, 2003).

We suggest that improvements are required to achieve greater transparency in GHG reporting and accounting related to bioenergy, so that the connections between forest carbon stock change and use of biomass for energy are not overlooked (Cowie et al., 2017; Kurz et al., 2018; Searchinger

et al., 2018). But rather than counting bioenergy emissions at the point of combustion, which would inhibit the beneficial use of wood products and forest bioenergy for climate change mitigation, we suggest that rules should ensure that all parties include the land sector comprehensively and transparently in reporting and accounting with respect to their emissions reduction commitments, and apply consistent approaches to ensure that omissions and double-counting are avoided (Sato & Nojiri, 2019; Schlamadinger et al., 2007). Transparency and measures to prevent double-counting and perverse incentives are also important considerations in formulation of domestic policies to support national targets for climate action, to avoid bioenergy incentives causing 'leakage', inadvertently stimulating loss of forest carbon stock domestically or abroad (Fingerman et al., 2019; Searchinger et al., 2018), or indirectly increasing fossil fuel emissions (Cowie & Gardner, 2007).

Furthermore, it is not the purpose of national-level reporting and accounting of GHG emissions to ensure sound decision-making and practices by actors operating 'on the ground'. Rather, effective sustainability governance is also required, to provide appropriate incentives and boundaries for actors in the land use and energy sectors, that also takes into consideration issues beyond climate.

13 | CONCLUSION

Rapid transformation of all sectors of society is needed to phase out the use of fossil fuels that adds carbon dioxide to the atmosphere causing global warming that is irreversible on timescales relevant for humans. The use of sustainable forest biomass for energy (heat, electricity or transport fuels) can effectively reduce fossil fuel use in the short term, and can contribute to phasing out use of fossil fuels in technologies and infrastructure that rely on carbon-based fuels, reducing future emissions. Furthermore, when combined with CCS, forest bioenergy can deliver CDR, likely to be required to meet the Paris Agreement's long-term temperature goal.

Misleading conclusions on the climate effects of forest bioenergy can be produced by studies that focus on emissions at the point of combustion, or consider only carbon balances of individual forest stands, or emphasize short-term mitigation contributions over long-term benefits, or disregard system-level interactions that influence the climate effects of forest bioenergy. Payback time calculations are influenced by subjective methodology choices and do not reflect the contribution of bioenergy within a portfolio of mitigation measures, so it is neither possible nor appropriate to declare a generic value for the maximum acceptable payback time for specific forest bioenergy options.

To answer the key question 'what are the climate implications of policies that promote bioenergy?' assessment

should be made at the landscape level, and use a full life cycle approach that includes supply chain emissions, changes in land carbon stocks and other variables influenced by the policies studied. Effects on land cover, land management and the wood products and energy sectors need to be considered, including indirect impacts at international level. The bioenergy system should be compared with reference scenarios (counterfactuals) that describe the most likely alternative land use(s) and energy sources that would be displaced by the bioenergy system, and the probable alternative fates for the biomass being utilized. A no-harvest counterfactual is not realistic in most current circumstances, but markets that pay for carbon sequestration and other ecosystem services could change incentives for harvest in future.

Holistic assessments show that forests managed according to sustainable forest management principles and practices (around one billion hectares globally, of which over 420 million hectares are certified; UNECE FAO, 2019) can contribute to climate change mitigation by providing bioenergy and other forest products that replace GHG-intensive materials and fossil fuels, and by storing carbon in the forest and in long-lived forest products. Assessments also show that the impact of bioenergy implementation on net GHG emission savings depends on both feedstock and context, as many important factors vary across regions and time. Demand for forest bioenergy can influence land use and forest management decisions, and the wood products sector, and these effects can augment or diminish the mitigation value.

The issue of timing of mitigation benefits needs to be considered within a holistic assessment that includes land carbon dynamics and energy system transition. As for other mitigation options, the perceived attractiveness of specific forest bioenergy options is influenced by the priority given to near-term versus longer term climate objectives. It is important to consider how forest bioenergy and forest management more broadly can serve both short-term and long-term objectives.

With respect to the treatment of bioenergy in UNFCCC reporting and accounting, we disagree with proposals to count emissions at the point of combustion, which could have adverse climate impacts. We recommend that complete and transparent reporting and accounting be applied consistently across the whole land sector, to ensure recognition of the interactions between terrestrial carbon stocks and biomass use for energy and other purposes, and to incentivize land use and management systems that deliver climate benefits.

Effective sustainability governance is required to ensure that forest biomass used for energy makes a positive contribution to mitigating climate change, and to broader environmental and socioeconomic objectives. The sustainability governance being developed and implemented

for bioenergy through the Global Bioenergy Partnership (GBEP, 2020) and the revised EU Renewable Energy Directive ('REDII'; European Commission, 2018) applies measures to ensure climate benefits, and includes, inter alia, safeguards for food security and areas of high conservation value, for example. Consistent application of sustainability governance measures globally and across the whole land sector would support achievement of the Sustainable Development Goals.

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DATA AVAILABILITY STATEMENT

There is no data available, as no new data were produced in this study.

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